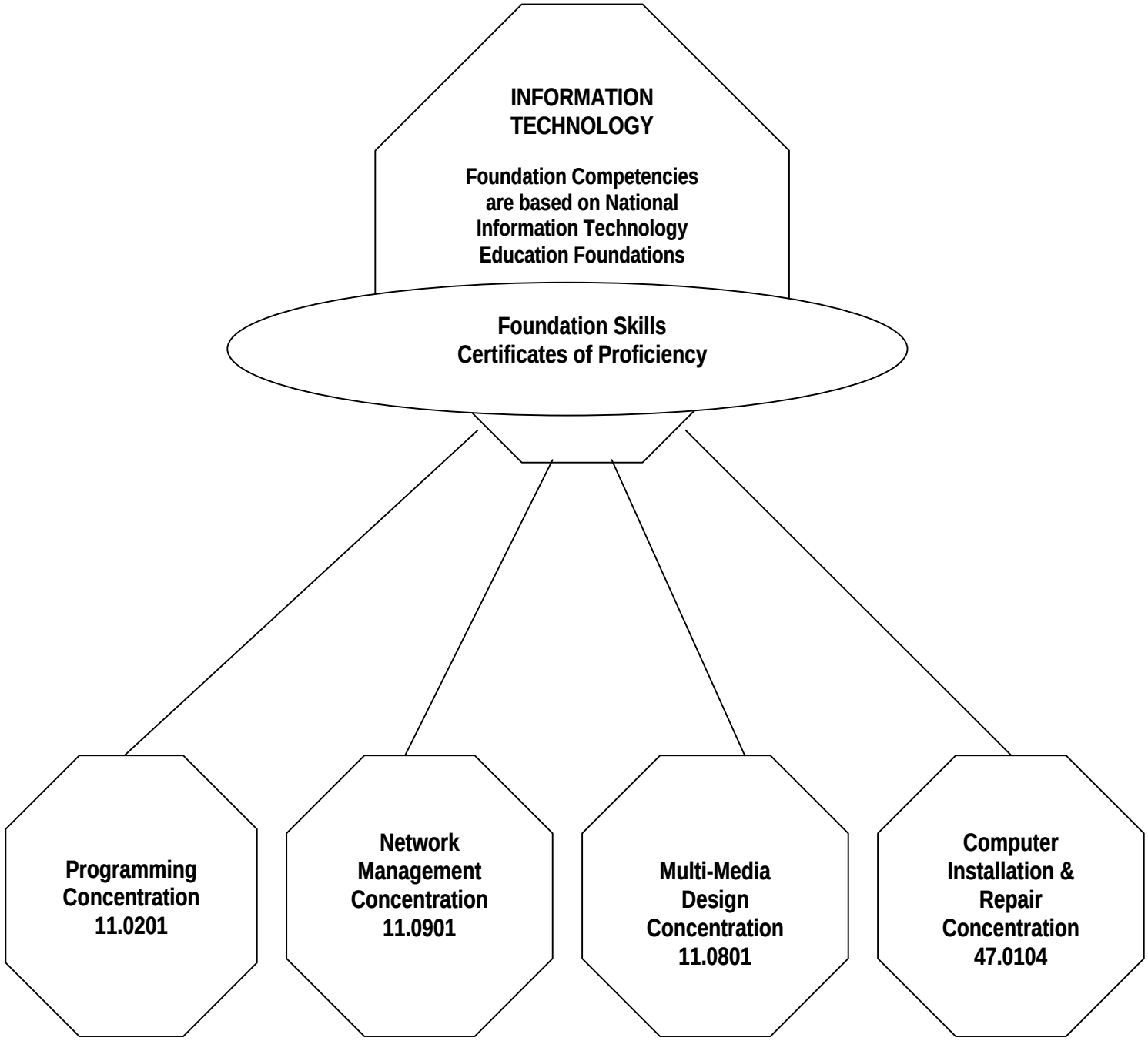
Information Technology Program
Career Cluster: Information Technology
May 2003



Program completion requires meeting the Foundation Competencies and the competencies of at least four modules in an area of concentration

Program: Information Technology
Career Cluster: Information Technology

Concentration Areas:

Programming
Network Management
Multi-Media Design
Computer Installation & Repair

Program Scope and Content: To earn one-year program certificate the student must complete all core competencies PLUS the competencies of at least 4 modules of a concentration area. Concentration areas include Programming, Network Management, Multi-Media Design, and Computer Installation & Repair.

Foundation Core Competencies - The Foundation Core Competencies are based on the National Information Technology Career Cluster foundation knowledge and skills and where in part generated from the National Skill Standards Board project carried out by the Northwest Center for Emerging Technologies. The foundation competencies are prerequisite and career sustaining levels, which provide a fundamental foundation and understanding of principles in order to be effective as an IT professional.

This industry based program, taught in Career and Technical Centers, provides students with the opportunity to apply theory based instruction through hands-on experiences such writing and testing computer programs, developing state-of-the-art web pages, establishing and managing databases, designing and building networks and network systems, repairing computer hardware and system troubleshooting. This program provides multiple pathways to post-secondary education and careers within the information technology industry including design, development, planning, and maintenance of information technology products and systems. A national effort is underway to establish skill standards for this industry that offers opportunities not only for entry level and part-time workers, but also for full-time employees to move upward into management. Career and technical training programs will provide a career ladder approach. More details on instructional methods and strategies (including work-based experiences) follow:

Links with Industry and Industry Certifications

Computer Programming Certificate Title: Programming Scenario Assessments. Starting in 2002, a series of programming assessments were developed in cooperation with IBM, IDX, and National Life Corporation through Barre Technical Center. These assessments are being pilot tested in the spring of 2003. The assessments are based on a real life situation designed to address the appropriate level of instruction. The assessments use the national career cluster protocol for assessment and certification and include technical, academic and workplace skills and knowledge.

Network Management Certificate Title: Cisco Certified Design Associate. The CCDA certification (Cisco Certified Design Associate) indicates a foundation or apprentice knowledge of network design for the Cisco Internetwork Infrastructure. CCDA certified professionals can design routed and switched network infrastructures involving LAN, WAN, and dial access services for businesses and organizations. For more information go to **http://www.cisco.com/en/US/learning/le3/le11/learning_about_registering_for_exams.html** or **http://www.cisco.com/en/US/learning/le3/le2/le0/le4/learning_certification_type_home.html**

Another certification available to Network Management programs is the **Cisco Certified Network Associate.** The CCNA certification (Cisco Certified Network Associate) indicates a foundation in and apprentice knowledge of networking. CCNA certified professionals can install, configure, and operate LAN, WAN, and dial access services for small networks (100 nodes or fewer), including but not limited to use of these protocols: IP, IGRP, Serial, Frame Relay, IP RIP, VLANs, RIP, Ethernet, Access Lists. More information can be obtained at
http://www.cisco.com/en/US/learning/le3/le11/learning_about_registering_for_exams.html or
http://www.cisco.com/en/US/learning/le3/le2/le0/le4/learning_certification_type_home.html

Also, a consortium of IT business known as Comptia offers a certification in the technical components of networking administration and support. **CompTIA Network+ Certification** is the worldwide standard of

competency for professionals with nine months experience in network support or administration. The Network+ certification validates technical competency in networking administration and support. Those holding Network+ certification demonstrate critical knowledge of media and topologies, protocols and standards, network implementation and network support. This certification is geared toward those with nine months field experience in network administration and support although may be applied upon completion of a career and technical center program. More information is available at **http://www.comptia.org/certification/network/default.asp**

Multi-Media Design Certificate Title: CompTIA i-Net+. The CompTIA i-Net+ certification is the worldwide standard of foundational-level competency in knowledge of Internet, Intranet and Extranet technologies. The i-Net+ certification is recognized as a baseline technical knowledge specifically designed to certify entry-level Internet and e-commerce technical professionals. Those holding i-Net+ certification demonstrate knowledge and competency in Internet basics and clients, development, networking, Internet security and business concepts. More information is available at **http://www.comptia.org/certification/i-net/default.asp**

Computer Installation & Repair Certificate Title: CompTIA A+ Certification. The CompTIA A+ certification is the industry standard for validating vendor-neutral skills expected of an entry-level computer technician. Those holding the A+ certification have a broad base of knowledge and competency in core hardware and operating system technologies including installation, configuration, diagnosing, preventive maintenance and basic networking. For more information go to **http://www.comptia.org/certification/a/default.asp**

In addition, Information Support and Maintenance program participants may be eligible for the **CompTIA i-Net+** certification which again, is recognized as a baseline technical knowledge specifically designed to certify entry-level Internet and e-commerce technical professionals. Those holding i-Net+ certification demonstrate knowledge and competency in Internet basics and clients, development, networking, Internet security and business concepts.

More information is available at http://www.comptia.org/certification/i-net/default.asp

Occupational Information and Outlook:

Information Technology includes the obvious firms such as those directly involved in software development, networking, hardware installation/maintenance, and information processing but also IT dependent jobs in other sectors including manufacturing, health care, banking, insurance, retailing, construction, travel/tourism, and others. Thus, unlike our traditional concept of an economic sector, the "IT Sector" is in fact an occupational area with a skill set that has a high degree of utility and adaptability to a wide range of work environments. Improving the IT skills of our workforce will have beneficial effects not limited to firms in the IT business. Workers with these skills will have an increasingly wide range of workplaces in which to apply their expertise. The following is information from the Bureau of Labor and Statistics:

Computer Hardware Engineers - The number of computer hardware engineers is relatively small compared with the number of other computer-related workers who work with software or computer applications. About 25 percent have been employed in computer and data processing services.

Computer hardware engineers are expected to have favorable job opportunities. Employment of computer hardware engineers is projected to increase faster than the average for all occupations through 2010, reflecting rapid employment growth in the computer and office equipment industry, which employs the greatest number of computer engineers.

Median annual earnings of computer hardware engineers were $67,300 in 2000. Median annual earnings in the industries employing the largest numbers of computer hardware engineers in 2000 were: Computer and office equipment at $75,730, Computer and data processing services at 69,490, Electronic components and accessories at 67,800, Telephone communication at 59,160. Starting salaries for

computer engineers with a bachelor's degree can be significantly higher than salaries of bachelor's degree graduates in many other fields.

Computer Programmers - Programmers are employed in almost every industry, but the largest concentration is in the computer and data processing services industry, which includes firms that write and sell software.
Employment of programmers is expected to grow about as fast as the average for all occupations through 2010. Jobs for both systems and applications programmers should be most plentiful in data processing service firms, software houses, and computer consulting businesses.

Employment of programmers, however, is expected to grow much slower than that of other computer specialists. As the level of technological innovation and sophistication increases, programmers should continue to face increasing competition from programming businesses overseas where much routine work can be contracted out at a lower cost. Nevertheless, employers will continue to need programmers who have strong technical skills and who understand an employer's business and its programming needs.

Median annual earnings of computer programmers were $57,590 in 2000. Median annual earnings in the industries employing the largest numbers of computer programmers in 2000 were: Personnel supply services at $65,780, Professional and commercial equipment at 63,780, Computer and data processing services at 61,010, Commercial banks at 60,180, and Management and public relations at 57,120.

Computer Software Engineers - Although they are employed in most industries, the largest concentration of computer software engineers, almost 46 percent, is in the computer and data processing services industry. This industry includes firms that develop and produce prepackaged software and firms that provide contractual computer services such as computer programming, systems integration, and information retrieval, including online databases and Internet services.
Computer software engineers are projected to be the fastest growing occupation from 2000 to 2010. Very rapid employment growth in the computer and data processing services industry, which employs the greatest numbers of computer software engineers, should result in very favorable opportunities for those college graduates with at least a bachelor's degree in computer engineering or computer science and practical experience working with computers. Employers will continue to seek computer professionals with strong programming, systems analysis, interpersonal, and business skills.

Median annual earnings of computer software engineers, applications, who worked full time in 2000 were about $67,670. Median annual earnings in the industries employing the largest numbers of computer applications software engineers in 2000 were: Computer and office equipment at $74,300, Computer and data processing services at 69,520, Engineering and architectural services at 68,790, Professional and commercial equipment at 64,920, and Management and public relations at 62,660.

Computer Support Specialists and Systems Administrators – Computer support specialists and systems administrators held about 734,000 jobs nationally in 2000. Of these, about 506,000 were computer support specialists and about 229,000 were network and computer systems administrators. Although they worked in a wide range of industries, about one-third of all computer support specialists and systems administrators were employed in business services industries, principally computer and data processing services.
Computer support specialists and systems administrators are projected to be among the fastest growing occupations over the 2000-10 period. Employment is expected to increase much faster than the average for all occupations as organizations continue to adopt and integrate and data processing services, which is projected to be the fastest growing industry in the U.S. economy. Demand for computer support specialists is expected to increase because of the rapid pace of improved technology. As computers and software become more complex, support specialists will be needed to provide technical assistance to customers and other users. Demand for systems administrators will grow as a result of the upsurge in electronic commerce and as computer applications continue to expand. Companies are looking for workers knowledgeable in the function and administration of networks.

Due to the rapid growth in demand for computer support specialists and systems administrators, those who have strong computer skills but do not have a bachelor's degree should continue to qualify for some entry-level positions. However, certifications and practical experience are essential for persons without degrees.

Median annual earnings of computer support specialists were $36,460 in 2000. Median annual earnings in the industries employing the largest numbers of computer support specialists in 2000 were: Professional and commercial equipment at $42,970, Computer and data processing services at 37,860, Personnel supply services at 34,080, Colleges and universities at 32,830, and Miscellaneous business services at 21,070. Median annual earnings of network and computer systems administrators were $51,280 in 2000. Median annual earnings in the industries employing the largest number of network and computer systems administrators in 2000 were: Professional and commercial equipment at $42,970, Computer and data processing services at 37,860, Personnel supply services at 34,080, Colleges and universities at 32,830, and Miscellaneous business services at 21,070.

Systems Analysts, Computer Scientists, and Database Administrators

Systems analysts, computer scientists, and database administrators held about 887,000 jobs in 2000. Although they are increasingly employed in every sector of the economy, the greatest concentration of these workers is in the computer and data processing services industry.

Systems analysts, computers scientists, and database administrators are expected to be among the fastest growing occupations through 2010. Employment of these computer specialists is expected to increase much faster than the average for all occupations as organizations continue to adopt and integrate increasingly sophisticated technologies.

Median annual earnings of computer systems analysts were $59,330 in 2000. Median annual earnings in the industries employing the largest numbers of computer systems analysts in 2000 were: Computer and data processing services at $64,110, Professional and commercial equipment at 63,530, Federal Government at 59,470, Local Government at 52,490, and State Government at 51,230. Median annual earnings of database administrators were $51,990 in 2000. Median annual earnings of network systems and data communication analysts were $54,510 in 2000. Median annual earnings of computer and information scientists, research, were $70,590 in 2000. According to Robert Half International, starting salaries in 2001 ranged from $72,500 to $105,750 for database administrators. Salaries for Internet-related occupations ranged from $58,000 to $82,500 for webmasters and $56,250 to $76,750 for Internet/Intranet developers.

The Career and Technical Education Information Technology programs provide for well-rounded training in the IT area with broad-based career training opportunities and clear career paths in each of the three concentration areas. Industry representatives (see below) tell of the importance of cross training in the IT industry to broaden career horizons and keep trained employees thriving in the business for the long-term. Broad-based training provides the best opportunity for advancement of those choosing IT as a career.

- Effective professionals have strong, life long learning foundation skills;
- Having broad foundational skills prepare individuals for careers as well as jobs;
- Narrowly defined training nominally prepares individuals for a job, however, without broad foundation skills, not a career—in some cases, results in almost immediate obsolete skills;
- Need life long learners who can easily adapt to persistent technical, job and market changes;
- Series of skill assessments and credentials need to be articulated along educational process;
- Model education of professionals along education to become a doctor, i.e., broad based foundational knowledge becoming more focused during undergraduate education;
- Changes (technology, organizational and market) occur so rapidly that traditional static education and training systems are minimally effective, minimal return on investment;

- Scenario assessments, if properly administered, can measure foundation and technical survey skills and knowledge along education process beginning in 8th grade – i.e., Programming Pilot Assessment;
- There is concern that traditional vocational-technical education programs prepare students for jobs that will be obsolete in the immediate future as opposed to producer oriented foundational skills that are more marketable;
- Education should find ways to include professionals in classroom on a consistent basis;
- Traditional technical training process used by education and registered apprenticeship programs is not applicable for developing professionals. Need new paradigm model;
- Use multi-delivery educational processes to include web based programs and interactive video;
- Graduates of vocational-technical center programs should have portfolio to include performance-based assessments demonstrating proficiency of all foundation skills as a minimum as well as an entry level technical concentration;
- 10th graders by the end of the year should have a minimal level of proficiency in all foundation skills and be assessed;
- Non-company specific assessments and credentials need to be developed, valued by employers (including registered apprenticeship programs) and college programs.

In Vermont the labor market information for information technology occupations reflect the following:

Occupation	**Median Annual Wages**	**Projected Annual Growth**
Programmers	$51,000	1.4%
Software Engineers	$70,000	2.5%
Database Administrators	$49,000	3.7%
Network Admin Comp. Systems	$44,000	4.4%
Network Admin. Data Commun.	$52,900	4.0%
Computer Analyst	$51,700	2.6%
Computer Support Specialist	$36,600	5.1%

Vermont Framework Standards:

Standards -Fields of Knowledge (Academics) and Vital Results Addressed within the *Vermont Framework of Standards and Learning Opportunities:*

Fields of Knowledge Addressed:

Science, Math and Technology:

7.2 – Students design and conduct a variety of their own investigations and projects.
7.3 – Students understand the nature of mathematical, scientific, and technological theory.
7.11 – Students analyze and understand living and non-living systems as collections of interrelated parts and interconnected systems.
7.12 – Students understand forces and motion, the properties and composition of matter, and energy sources and transformations.
7.17 – Students apply knowledge and understanding of technological systems to respond to a variety of issues.
7.18 – Students understand that people control the outputs and impacts of our expending technological activities in the areas of communication, construction, manufacturing, power and transportation, energy sources, health technology, and biotechnology.
7.19 – Students use technological/engineering processes to design solutions to problems.

Vital Results Addressed:

Communications:

1.8 – In written reports, students organize and convey information and ideas accurately and effectively.
1.10 – In written narratives, students organize and relate a series of steps that a reader can follow.
1.13 – Students listen and respond to communications.
1.14 – Students critique what they have heard.
1.15 – Students use verbal and nonverbal skills to express themselves effectively.
1.17 – Students interpret and communicate using mathematical, scientific, and technological notation and representation.
1.18 – Students use computers, telecommunications, and other tools of technology to research, to gather information and ideas, and to represent information and ideas accurately and appropriately.
1.19 – Students use organizational systems to obtain information from various sources.
1.20 – Students use graphs, charts, and other visual presentations to communicate data accurately and appropriately.
1.21 – Students select appropriate technologies and applications to solve problems and to communicate with an audience.
1.22 – Students employ a variety of techniques to use simulations and to develop models.

Reasoning and Problem Solving:

2.2 – Students use reasoning strategies, knowledge, and common sense to solve complex problems related to all fields of knowledge.
2.3 – Students solve problems of increasing complexity.
2.4 – Students devise and test ways of improving the effectiveness of a system.
2.10 – Students generate several ideas using a variety of approaches.
2.11 – Students represent their ideas and/or the ideas of others in detailed form.
2.12 – Students modify or change their original ideas and/or the ideas of others to generate innovative solutions.
2.13 – Students design a product, project, or service to meet an identified need.
2.14 – Students plan and organize an activity.

Personal Development:

3.3 – Students demonstrate respect for themselves and others.
3.10 – Students perform effectively on teams that set and achieve goals, conduct investigations, solve problems, and create solutions.
3.11 – Students interact respectively with others, including those with whom they have differences.

3.12 – Students us systemic and collaborative problem-solving processes, including mediation, to negotiate and resolve conflicts.
3.13 – Students analyze their roles and responsibilities in their family, their school, and their community.
3.14 – Students demonstrate dependability, productivity, and initiative.
3.15 – Students know about various careers.
3.16 – Students develop a plan for current and continued education and training to meet personal and career goals.

Human Diversity:

4.3 – Students demonstrate understanding of the cultural expressions that are characteristic of particular groups.
4.4 – Students demonstrate understanding of the concept of prejudice, and its effect on various groups.

Embedded Credit: Mathematics for Programming and Information Support and Maintenance; Science for Interactive Media and Network Management.

Articulation Agreements: Champlain College, Johnson State College, University of Vermont, Vermont Technical College, Community College of Vermont, Lyndon State College and Castleton State Collegeas well as connections with Registered Apprenticeship being developed.

Possible Assessments through: Career Cluster Foundation assessments in basic IT applications, communications, and employablility (VTECS 2003), Scenarios, Rubrics, Portfolios, Brainbench (www.brainbench.com), NOCTI, National States' Career Cluster Initiative, Education Development Center, Newton, MA, Vermont IT Industry Partnership (Spring 2003).

Youth Leadership: The Leadership and Teamwork Competencies may be met through **VICA, FBLA, DECA, and FCCLA** co-curricular activities

Required License: Trades and Industry-Information Technology or Information Technology in Business

RESOURCES

1. Occupational Outlook Handbook 2001-2002 US Dept. of Labor
2. O'Net Resource Center www.onetcenter.org US Dept. of Labor
3. Northwest Center for Emerging Technologies, www.nwcet.org
4. EDC, Education Development Center, Newton, MA, www.edc.org/ewit
5. National Career Cluster Initiative
6. Ohio IT Works Project
7. Vermont Department of Employment and Training
8. Comptia
9. Cisco Corporation
10. NSSB, National Skill Standards Board
11. HRIC, Human Resources Investment Council
12. VTC, Vermont Technical College
13. CCV, Community College of Vermont
14. Indiana Office of Workforce Development
15. Building Linkages Among Occupational and Academic Skill Standards (1st Career Cluster Project)
16. US Dept. of Education – Office of Vocational and Adult Education,
17. Vermont Framework of Standards and Learning Opportunities,
18. American Hotel and Lodging Association www.ahma.com
19. National Life of Vermont,
20. IDX Corporation
21. IBM Corporation

Special thanks goes to the following individuals for their special work with this project:

Scott Griggs, Barre Regional Career and Technical Center
Karen Baron, Barre Regional Career and Technical Center
Steve Briggs, Stafford Technical Center
John Martell, Stafford Technical Center
LeRoy Martelle, Hartford Career and Technology Center
Mary Hazard, Lyndon Institute
Doris Jewett, Randolph Area Vocational Center
Steve Barner, Cisco and South Burlington High School
Dave Cousins, Center of Technology, Essex
Jennifer Fribush, River Valley Technical Center
Gail Fletcher, River Valley Technical Center
Lucie deLaBruere, Vermont Institutes
Jane Donahue-Holt, Burlington Technical Center
Dan Kane, Southwest Vermont Career Development Center
Theodora Contis, Mathematics/Science Teacher, Essex High School
Robin Winters, Mathematics Teacher, Champlain Valley Union High School
Paul Noiseux, Science Teacher, Whitcomb High School
Greg Renner, Science Teacher, Oxbow High School

FOUNDATION COMPETENCIES

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

INFORMATION TECHNOLOGY BASICS

Aligned with Vermont Standards: 1.18, 7.11, 7.17, 7.18

0 1 2 3 4

θθθθθ **A. Demonstrate basic knowledge of the history of information technology**

θθθθθ **B. Demonstrate knowledge of the impact of information technology on society**

θθθθθ **C. Demonstrate knowledge of Health, Safety and Environmental Considerations**

BASIC HARDWARE, SOFTWARE AND TROUBLESHOOTING

Aligned with Vermont Standards: 1.14, 1.18, 1.19, 2.2, 7.2, 7.3, 7.17

θθθθθ **D. Demonstrate knowledge of the hardware components associated with information systems**

θθθθθ **E. Demonstrate knowledge of the operating systems and applications associated with information systems**

θθθθθ **F. Demonstrate Knowledge of System Operation**

DATA COMMUNICATIONS AND THE INTERNET

Aligned with Vermont Standards: 1.18, 7.17, 7.18

θθθθθ **G. Demonstrate basic knowledge of the Internet & data communications**

COMMUNICATION

Aligned with Vermont Standards: 1.8, 1.10, 1.13, 1.14, 1.15, 1.17, 1.18, 1.19, 1.20, 1.21, 1.22

θθθθθ **H. Compose reports**

θθθθθ **I. Deliver oral presentations**

ETHICS AND LEGAL RESPONSIBILITIES

Aligned with Vermont Standards: 4.3, 4.4

θθθθθ **J. Demonstrate knowledge of intellectual property rights covered by intellectual law**

EMPLOYABILITY AND CAREER DEVELOPMENT

Aligned with Vermont Standards: 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16

θθθθθ **K. Demonstrate the capacity to plan and manage careers and employment relations.**

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

Information Technology Basics

Aligned with Vermont Standards: 1.18, 7.11, 7.17, 7.18

0 1 2 3 4

θθθθθ **A. Demonstrate basic knowledge of the evolution of information technology**

- A.001 Demonstrate knowledge of significant advances in the development of computer hardware and software
- A.002 Demonstrate knowledge of major milestones in the development of information technology
- A.003 Demonstrate knowledge of major individuals and their contributions to the information technology field
- A.004 Demonstrate knowledge of the speed with which computer technology has evolved (i.e., evolution time line)

θθθθθ **B. Demonstrate knowledge of the impact of information technology on society**

- B.001 Demonstrate knowledge of how both PCs and larger computer systems impact people and are used in business/industry/government and other institutions
- B.002 Demonstrate knowledge of the impact of computers on career pathways in business/industry (e.g., how computers have eliminated and created jobs)
- B.003 Demonstrate knowledge of the impact of computers on access to information and information exchange worldwide
- B.004 Demonstrate knowledge of how information technology affects the natural environment (e.g., disposal of equipment, energy use, use of natural resources)
- B.005 Demonstrate knowledge of proper disposal of electronic equipment
- B.006 Demonstrate knowledge of the impact of electronic waste on the environment and local populations

θθθθθ **C. Demonstrate knowledge of Health, Safety and Environmental Considerations**

- C.001 Demonstrate knowledge of ergonomics and repetitive strain injuries
- C.002 Demonstrate knowledge of personal safety issues when working on electrical/electronic systems
- C.003 Solve safety problems using problem solving, decision making, and critical thinking strategies
- C.004 Demonstrate knowledge of the psychological and health risks associated with computers, i.e., safe worksite procedures.

BASIC HARDWARE, SOFTWARE AND TROUBLESHOOTING

Aligned with Vermont Standards: 1.14, 1.18, 1.19, 2.2, 7.2, 7.3, 7.17

θθθθθ **D. Demonstrate knowledge of the hardware components associated with information systems**

- D.001 Identify the three main classifications of computers (i.e., Personal, Server, and Mainframes)
- D.002 Identify the elements of the information processing cycle (i.e., input, process, output, and storage)
- D.003 Identify major hardware components and their functions
- D.004 Identify types of computer storage devices
- D.005 Demonstrate knowledge of number systems and internal data representation

D.006 Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts)

θθθθθ **E. Demonstrate knowledge of the operating systems and applications associated with information systems**

E.001 Identify hardware requirements and capabilities for a given software application (e.g., processor, memory, disk space, communications, printers, monitors)
E.002 Install given application/system software in accordance with manufacturer's procedures
E.003 Access needed help using contextual help or Internet sites
E.004 Document step-by-step installation and configuration procedures
E.005 Demonstrate knowledge of operating system architecture types
E.006 Demonstrate knowledge of the system utilities used for file management
E.007 Differentiate between files and directories
E.008 Differentiate between types of storage devices (e.g., disk, tape, CD-ROM)
E.009 Demonstrate a basic working knowledge of word processors.
E.010 Demonstrate a basic working knowledge of spreadsheets.
E.011 Demonstrate a basic working knowledge of database applications.
E.012 Demonstrate a basic working knowledge of presentation software.
E.013 Demonstrate appropriate use of the Internet.
E.014 Demonstrate knowledge of e-mail etiquette by creating e-mail messages in accordance with established business standards.
E.015 Practice a code of ethics for information systems.

θθθθθ **F. Demonstrate knowledge of System Operation**

F.001 Inspect computer and/or monitor power switches to determine if they are functioning properly.
F.002 Adjust screen controls for optimum image.
F.003 Inspect keyboard and mouse cable and pins to determine whether it is properly connected to the system
F.004 Determine if MS-DOS (or some other bootable operating system) is available to boot the system
F.005 Boot system, watching screen for visual error messages, listening for tone (beep) error messages, and noting error messages

DATA COMMUNICATIONS AND THE INTERNET

Aligned with Vermont Standards: 1.18, 7.17, 7.18

θθθθθ **G. Demonstrate basic knowledge of the Internet & data communications**

G.001 Demonstrate knowledge of how to conduct searches using electronic sources (e.g., selection of search terms)
G.002 Evaluate quality and usability of electronic information
G.003 Identify the key characteristics of the Internet
G.004 Demonstrate knowledge of the ownership/administration of the Internet
G.005 Demonstrate knowledge of accepted Internet etiquette (netiquette)
G.006 Identify current uses and applications of the Internet
G.007 Demonstrate awareness of virus protection techniques
G.008 Install/upgrade web browser
G.009 Access an array of multimedia capabilities of the World Wide Web

COMMUNICATION

Aligned with Vermont Standards: 1.8, 1.10, 1.13, 1.14, 1.15, 1.17, 1.18, 1.19, 1.20, 1.21, 1.22

θθθθθ **H. Compose reports**

H.001 Identify the appropriate type of software to present data
H.002 Evaluate audience
H.003 Gather information
H.004 Organize information and develop outline
H.005 Draft document in accordance with established standards for communication
H.006 Verify spelling, grammar, and punctuation
H.007 Verify accuracy of content
H.008 Prepare final document

θθθθθ **I. Deliver oral presentations**

I.001 Prepare presentation and supporting materials (e.g., handouts, transparencies, electronic slide shows)
I.002 Practice presentation
I.003 Deliver presentation incorporating both verbal and nonverbal communication skills
I.004 Obtain feedback on the effectiveness of presentation
I.005 Interpret oral, written, and nonverbal communications
I.006 Evaluate audience (e.g., specific interests, level of technical knowledge)
I.007 Determine means of communications appropriate for given situations (e.g., telephone, meeting, electronic mail, and written communication)

ETHICS AND LEGAL RESPONSIBILITIES

Aligned with Vermont Standards: 4.3, 4.4

θθθθθ **J. Demonstrate knowledge of intellectual property rights covered by intellectual law**

J.001 Demonstrate knowledge of the various forms of intellectual property rights (e.g., copyright, patent, trademark, trade secrets)
J.002 Demonstrate knowledge of First Amendment rights and software licensing issues
J.003 Identify the rights related to electronic imagery
J.004 Identify the liability for copyright infringement, slander and libel
J.005 Demonstrate knowledge of confidentiality issues and their liability implications
J.006 Demonstrate knowledge of the characteristics of warranties
J.007 Demonstrate knowledge of "Hacker" versus "Cracker" and the importance of personal integrity
J.008 Demonstrate knowledge of security issues and guidelines for legal usage of e-mail, contamination protection strategies for e-mail, and knowledge of e-mail etiquette
J.009 Have awareness of current and emerging laws in IT.
J.010 Demonstrate appropriate use of network resources.

EMPLOYABILITY AND CAREER DEVELOPMENT

Aligned with Vermont Standards: 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16

qqqqq **K. Demonstrate the capacity to plan and manage careers and employment relations.**

K.001 Explain written organizational policies, rules and procedures to help employees perform their jobs.
K.002 Identify and demonstrate positive work behaviors and personal qualities including appropriate language, worksite appearance and dress, and personal health and hygiene habits.
K.003 Identify and explore career opportunities in one or more career pathways
K.004 Develop a personal career plan to meet career goals and objectives.
K.005 Demonstrate ability to seek and apply for employment including preparing a resume, portfolio, and reference list, complete an error-free job application, and demonstrate effective job interviewing skills.

K.006 Demonstrate ability to evaluate and compare employment opportunities and accept employment

K.007 Provide examples of how IT is transforming business in various industries

K.008 Demonstrate knowledge of the relationship between lifelong learning and IT career development

K.009 Demonstrate knowledge of career development/progression patterns in the IT industry

K.010 Read technical literature to update and maintain a level of current technical knowledge.

PROGRAMMING CONCENTRATION
CIP: 11.0201

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

STRUCTURED PROGRAMMING THEORY

Aligned with Vermont Standards: 1.21, 2.2, 2.4, 7.3, 7.11, 7.12

0 1 2 3 4

θθθθθ **L. Demonstrate knowledge of structured programming language concepts**

PROGRAM DESIGN

Aligned with Vermont Standards: 1.21, 2.2, 2.4, 2.13, 2.14, 7.3, 7.17, 7.18

θθθθθ **M. Apply the process of algorithm and structured code development**

DEVELOP STRUCTURED COMPUTER PROGRAMS

Aligned with Vermont Standards: 1.13, 1.19, 1.21,1.22, 2.2, 2.4, 2.10, 2.14, 7.3, 7.17, 7.18

θθθθθ **N. Develop computer programs in accordance with programming theory**

ADVANCED DATA STRUCTURES

Aligned with Vermont Standards: 2.3, 2.4, 2.10, 2.11, 2.12, 2.13

θθθθθ **O. Develop advanced data structures in a structured programming language**

TESTING

Aligned with Vermont Standards: 1.2, 2.2, 2.3, 2.4, 2.10, 1.12, 2.13, 2.14, 7.2, 7.17, 7.19

θθθθθ **P. Writing robust programs (error handlers, debugging, and testing)**

DOCUMENTATION

Aligned with Vermont Standards: 1.8, 1.10, 1.13, 1.14, 1.17, 1.20, 1.21, 2.11

θθθθθ **Q. Demonstrate knowledge of technical documentation associated with software development**

MAINTENANCE

Aligned with Vermont Standards: 2.2, 2.4, 2.12

qqqqq **R. Demonstrate knowledge of software maintenance**

EXPRESSION ORIENTED PROGRAMMING

Aligned with Vermont Standards: 2.13, 7.19

qqqqq **S. Demonstrate and apply knowledge of expression oriented programming**

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

STRUCTURED PROGRAMMING THEORY

Aligned with Vermont Standards: 1.21, 2.2, 2.4, 7.3, 7.11, 7.12

0 1 2 3 4

θθθθθ **L. Demonstrate knowledge of structured programming language concepts**

- L.001 Demonstrate knowledge of the function and operation of compilers and interpreters
- L.002 Demonstrate knowledge of the basics of structured, object-oriented, and event-driven programming
- L.003 Demonstrate knowledge of current key programming languages and the environment they are used in (e.g., C, C++, Visual Basic, Java, Assembler)
- L.004 Demonstrate knowledge of the information system (IS) life cycle
- L.005 Demonstrate knowledge of the characteristics and uses of batch processing
- L.006 Demonstrate knowledge of the characteristics and uses of interactive processing
- L.007 Demonstrate knowledge of modern programming methods, such as the waterfall model, or extreme programming

PROGRAM DESIGN

Aligned with Vermont Standards: 1.21, 2.2, 2.4, 2.13, 2.14, 7.3, 7.17, 7.18

θθθθθ **M. Apply the process of algorithm and ~~structured~~ code development**

- M.001 Provide an overview of problem to be solved
- M.002 Break down the task into its functional components – ie the methods that will be used to solve the problem.
- M.003 Design program logic using both graphical and pseudocode techniques
- M.004 Describe the fundamental data types **in your plan** and their definitions
- M.005 Translate data structures and program design into code in a programming language
- M.006 Read algorithms developed by others
- M.007 Compare and contrast various algorithmic solutions to a problem, identifying pros and cons to each
- M.008 Complete a desk check of an algorithm to test its viability

DEVELOP STRUCTURED COMPUTER PROGRAMS

Aligned with Vermont Standards: 1.13, 1.19, 1.21,1.22, 2.2, 2.4, 2.10, 2.14, 7.3, 7.17, 7.18

θθθθθ **N. Develop computer programs in accordance with programming theory**

- N.001 Demonstrate knowledge of a variety of keywords and commands
- N.002 Save and load programs
- N.003 Use compile, edit and debug features of the ~~programming language~~ compiler
- N.004 Demonstrate the ability to use standard data types, constants and variables
- N.005 Demonstrate an understanding and handling of string data
- N.006 Design and write interactive programs and control screen Input/Output
- N.007 Use appropriate error trapping
- N.008 Understand and use formatting features of the language
- N.009 Demonstrate knowledge of iteration
- N.010 Demonstrate use of decision and selection structures
- N.011 Demonstrate knowledge and use of math operators
- N.012 Demonstrate knowledge and use of operator order of precedence
- N.013 Demonstrate knowledge and use of relational and logical operators
- N.014 Use counters and accumulators to produce summary information
- N.015 Use menus and procedures/functions to control flow of complex programs

N.016 Demonstrate knowledge and use of single-dimension arrays
N.017 Demonstrate knowledge and use of two-dimension arrays
N.018 Demonstrate knowledge and use of pre-defined and user-defined functions
N.019 Demonstrate the ability to write user-defined functions
N.020 Demonstrate an understanding of parameter passing
N.021 Develop and use data files
N.022 Use sorting effectively in a program
N.023 Use searching effectively in a program
N.024 Demonstrate an understanding and use of templates
N.025 Demonstrate an understanding and use of classes

ADVANCED DATA STRUCTURES

Aligned with Vermont Standards: 2.3, 2.4, 2.10, 2.11, 2.12, 2.13

θθθθθ **O. Develop advanced data structures in a structured programming language**

O.001 Demonstrate an understanding and use of linked lists
O.002 Demonstrate an understanding and use of inserting linked lists
O.003 Demonstrate an understanding and use of deleting nodes and saving linked list to storage disk.
O.004 Demonstrate an understanding and use of doubly and circularly linked lists.
O.005 Demonstrate an understanding and use of stacks
O.006 Demonstrate an understanding and use of queues
O.007 Demonstrate an understanding an use of binary trees
O.008 Demonstrate an understanding and use of hash tables
O.009 Demonstrate an understanding of recursion
O.010 Demonstrate an understanding and ability to create classes

TESTING

Aligned with Vermont Standards: 1.2, 2.2, 2.3, 2.4, 2.10, 1.12, 2.13, 2.14, 7.2, 7.17, 7.19

θθθθθ **P. Writing robust programs (error handlers, debugging, and testing)**

P.001 Write programs that handle solvable run-time errors such as data entry errors and file-not-found, divide by zero, etc.
P.002 Correct syntax and lexical errors allowing programs to compile
P.003 Correct common run-time errors
P.004 Create test data and plan for checking logic and error routines
P.005 Execute program with test data
P.006 Analyze test results
P.007 Correct logic errors
P.008 Retest programs
P.009 Thoroughly test programs to make sure they follow specifications, and that all sources of possible error are handled appropriately.

DOCUMENTATION

Aligned with Vermont Standards: 1.8, 1.10, 1.13, 1.14, 1.17, 1.20, 1.21, 2.11

θθθθθ **Q. Demonstrate knowledge of technical documentation associated with software development**

Q.001 Document program specifications
Q.002 Identify constraints
Q.003 Identify input and output (I/O) requirements
Q.004 Write program that include comments, tabs, white space and variable naming conventions that allow for self-documenting code.

Q.005 Write useful user documentation that describes the program and it's limitations and allows the user to run the program and resolve common problems.

MAINTENANCE

Aligned with Vermont Standards: 2.2, 2.4, 2.12

θθθθθ **R. Demonstrate knowledge of software maintenance**

R.001 Modify existing code to perform as specified
R.002 Design a solution
R.003 Describe how the code will be modified to meet the stated objectives
R.004 Determine where the modifications will be inserted into the existing code
R.005 Determine how the modifications will affect the remainder of the code, and plan necessary adjustments
R.006 Complete a formal desk check of the algorithm to ensure that the solution works
R.007 Develop a test plan that will be used to validate the final program
R.008 Write modifications in style of existing code
R.009 Code using coding techniques discussed above
R.010 Test and evaluate using techniques discussed above
R.011 Modify documentation to reflect modifications

EXPRESSION ORIENTED PROGRAMMING

Aligned with Vermont Standards: 2.13, 7.19

qqqqq **S. Demonstrate and apply knowledge of expression oriented programming**

S.001 Demonstrate ability to use an interpreter, compiler or editor
S.002 Demonstrate knowledge of basic data types (atoms and lists)
S.003 Demonstrate knowledge of basic pre-defined functions
S.004 Demonstrate ability to write user-defined functions
S.005 Demonstrate use of decision structures
S.005 Demonstrate use of recursion and iteration
S.006 Demonstrate knowledge of programming techniques
S.007 Demonstrate use of simple data structures

NETWORK MANAGEMENT CONCENTRATION
CIP: 11.0901

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

INTERNET

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

0 1 2 3 4

θθθθθ **L. Demonstrate advanced knowledge of the Internet (exposure)**

θθθθθ **M. Demonstrate knowledge of the OSI Reference Model**

HARDWARE DESIGN, OPERATION, AND MAINTENANCE

Aligned with Vermont Standards: 1.14, 1.18, 1.19, 2.2, 7.2, 7.3, 7.17

θθθθθ **N. Demonstrate knowledge of hardware standards**

θθθθθ **O. Analyze the computer site environment**

θθθθθ **P. Demonstrate knowledge of computer architecture and processor types**

θθθθθ **Q. Demonstrate a basic knowledge of connectivity devices**

OPERATING SYSTEMS

Aligned with Vermont Standards: 2.13, 7.3, 7.17

θθθθθ **R. Maintain security requirements**

θθθθθ **S. Employ computer system interfaces**

NETWORKING

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **T. Demonstrate knowledge of basic network classifications and topologies**

θθθθθ **U. Demonstrate knowledge of local-area network (LAN) trends and issues**

θθθθθ **V. Demonstrate knowledge of common network computing platforms**

θθθθθ **W. Demonstrate knowledge of LAN physical media**

θθθθθ **X. Demonstrate knowledge of network connectivity basics**

θθθθθ **Y. Demonstrate knowledge of LAN switching**

NETWORK ARCHITECTURES

Aligned with Vermont Standards: 7.17

θθθθθ **Z. Demonstrate knowledge of the basics of network architecture**

θθθθθ **AA. Demonstrate knowledge of network protocols**

θθθθθ **BB. Install basic system architectures using current Windows operating system software**

WIDE-AREA NETWORKS

Aligned with Vermont Standards: 7.17

θθθθθ **CC. Demonstrate knowledge of basic telecommunications and the interconnection of networks**

θθθθθ **DD. Demonstrate knowledge of WAN protocols**

NETWORK MANAGEMENT

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **EE. Perform network installation procedures**

θθθθθ **FF. Perform network operation procedures**

SYSTEM INSTALLATION AND MAINTENANCE

Aligned with Vermont Standards: 1.21, 7.12, 7.17

θθθθθ **GG. Perform system maintenance**

θθθθθ **HH. Perform software upgrades and fixes**

MANAGEMENT AND SUPERVISION

Aligned with Vermont Standards: 1.13, 1.14, 1.17, 1.20, 2.2, 2.3, 2.14, 3.3, 3.10, 3.11, 3.12

θθθθθ **II. Conduct meetings**

FUNDAMENTALS OF ELECTRONICS TECHNOLOGY

Aligned with Vermont Standards: 7.11, 7.12, 7.17, 7.18, 7.19

θθθθθ **JJ. Distinguish between analog and digital phenomena and circuits**

θθθθθ **KK. Demonstrate knowledge of the basic elements of communication interfacing**

θθθθθ **LL. Apply troubleshooting and repair techniques to a microcomputer system**

TELECOMMUNICATIONS

Aligned with Vermont Standards: 7.11, 7.12, 7.17, 7.18, 7.19

θθθθθ **MM. Demonstrate knowledge of transmission line applications**

θθθθθ **NN. Demonstrate proficiency in working with data communications**

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	**Introduced**	**Practiced**	**Entry-level**	**Competency**

INTERNET

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

0 1 2 3 4

θθθθθ **L. Demonstrate advanced knowledge of the Internet (exposure)**

- L.001 Demonstrate knowledge of the Transmission Control Protocol/Internet Protocol (TCP/IP) suite (ISS, NS, PSD, IM)
- L.002 Demonstrate knowledge of the Domain Name Server (DNS) (ISS, NS, PSD, IM)
- L.003 Demonstrate knowledge of Simple Network Management Protocol (SNMP)
- L.004 Demonstrate knowledge of Bootstrap Protocol (BOOTP) and Dynamic Host Configuration Protocol (DHCP)
- L.005 Demonstrate knowledge of the Address Resolution Protocol (ARP)
- L.006 Demonstrate knowledge of IP forwarding, encapsulation, and fragmentation
- L.007 Demonstrate knowledge of Internet security issues (ISS, NS, PSD, IM)
- L.008 Identify available Internet security systems

M. Demonstrate knowledge of the OSI Reference Model

- M.001 Identify and describe the functions of each of the seven layers of the OSI reference model.
- M.002 Describe connection-oriented network service and connectionless network service, and identify the key differences between them.
- M.003 Describe data link addresses and network addresses, and identify the key differences between them.
- M.004 Identify at least 3 reasons why the industry uses a layered model.
- M.005 Define and explain the 5 conversion steps of data encapsulation.
- M.006 Define flow control and describe the three basic methods used in networking.
- M.007 List the key internetworking functions of the OSI Network layer and how they are performed in a router.

HARDWARE DESIGN, OPERATION, AND MAINTENANCE

Aligned with Vermont Standards: 1.14, 1.18, 1.19, 2.2, 7.2, 7.3, 7.17

θθθθθ **N. Demonstrate knowledge of hardware standards**

- N.001 Identify standard-setting bodies
- N.002 Identify OSI, IEEE, ISO, and ITU-T (formerly CCITT) standards
- N.003 Demonstrate knowledge of the importance of conformance and use of operating system APIs (rather than direct manipulation of hardware)

θθθθθ **O. Analyze the computer site environment**

- O.001 Identify environmental requirements, conditions, and limitations
- O.002 Identify power requirements and power supplies
- O.003 Identify ergonomic issues
- O.004 Identify structural capacities
- O.005 Identify electrical wiring codes

θθθθθ **P. Demonstrate knowledge of computer architecture and processor types**

P.001 Demonstrate knowledge of microcomputer architecture and processors
P.002 Compare/contrast the features of different microcomputer processors
P.003 Demonstrate knowledge of minicomputer architecture and processors
P.004 Demonstrate knowledge of mainframe architecture and processors
P.005 Identify internal box components
P.006 Compare/contrast system bus structures (e.g., ISA, EISA, MCA, PCI, USB)
P.007 Evaluate architecture alternatives

θθθθθ **Q. Demonstrate a basic knowledge of connectivity devices**

Q.001 Demonstrate knowledge of the characteristics and operation of baluns
Q.002 Demonstrate knowledge of the characteristics and operation of multiplexers, modems, CODECS, DSU
Q.003 Demonstrate knowledge of the characteristics and operation of switches, gateways, bridges, routers, brouters, and repeaters
Q.004 Demonstrate knowledge of the characteristics and operation of test equipment (e.g., protocol analyzers)

OPERATING SYSTEMS

Aligned with Vermont Standards: 2.13, 7.3, 7.17

θθθθθ **R. Maintain security requirements**

R.001 Implement security procedures in accordance with business ethics
R.002 Ensure compliance with security rules, regulations, and codes
R.003 Maximize threat reduction
R.004 Assess exposure to security issues
R.005 Implement countermeasures
R.006 Maintain confidentiality
R.007 Load virus detection and protection software
R.008 Identify sources of virus infections
R.009 Remove viruses
R.010 Report viruses in compliance with company standards
R.011 Implement backup and recovery procedures
R.012 Demonstrate knowledge of potential internal and external threats to security
R.013 Follow disaster plan
R.014 Provide for user authentication (e.g., assign passwords, access level)
R.015 Demonstrate knowledge of virus protection strategy
R.016 Document security procedures
R.017 Network Security: configure, monitor and verify standard and extended access control lists to filter IP traffic

θθθθθ **S. Employ computer system interfaces**

S.001 Define hardware-software interface issues for a computer system
S.002 Identify standards and issues related to I/O programming and design of I/O interfaces
S.003 Interface peripheral devices/controllers in the computer system (e.g., software and hardware interrupts, exceptions, Direct Memory Addressing [DMA], bus structures)
S.004 Apply concepts of privileged instructions and protected mode programming
S.005 Configure peripheral device drivers (e.g., disk, display, printer, modem, keyboard, mouse, network)
S.006 Apply advanced I/O concepts (e.g., disk caching, data compression, extended memory, magnetic disk/CD-ROM storage and formats)
S.007 Identify CPU modes of operations
S.008 Allocate disk space, nonsharable resources, and I/O devices

NETWORKING

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **T. Demonstrate knowledge of basic network classifications and topologies**

T.001 Interpret basic networking terminology
T.002 Differentiate between LANs, MANs and WANs
T.003 Demonstrate knowledge of how to turn LANs into MANs and WANs
T.004 Identify the basic point-to-point network topologies (e.g., star, ring, tree, network, irregular)
T.005 Demonstrate knowledge of packet-switching techniques
T.006 Identify the basic broadcast topologies (e.g., star ring, bus)
T.007 Demonstrate knowledge of the characteristics of connection-oriented and connectionless networks
T.008 Identify standard high-speed networks (e.g., broadband, ISDN, SMDS, ATM, FDDI)
T.009 Identify emerging networks (e.g., ATM; ISDN; satellite nets; optic nets; integrated voice, data, and video)

θθθθθ **U. Demonstrate knowledge of local-area network (LAN) trends and issues**

U.001 Demonstrate knowledge of the reasons for installing a network
U.002 Trace the evolution of networks
U.003 Analyze current trends and developments in LANs

θθθθθ **V. Demonstrate knowledge of common network computing platforms**

V.001 Differentiate between personal computers and workstations
V.002 Identify the basic features of standard microprocessors (e.g., Intel family, RISC, Cyrix)
V.003 Identify standard memory types (e.g., RAM, ROM, PROM, EPROM, EEPROM)
V.004 Identify standard input/output devices (e.g., ISA, EISA, Micro Channel, PCI, universal serial bus, drive controllers, SCSI and SCSI 2, PCMCIA, firewire)
V.005 Identify the basic features of standard operating systems (e.g., Windows 3.1, 95, 98, 02 or latest CE, Workgroups, NT; OS/2; Macintosh OS; Solaris)
V.006 Identify the basic features of standard workstation processors
V.007 Identify standard CPU architectures for mid-range computers
V.008 Identify standard operating system software for mid-range computers
V.009 Identify basic mainframe capabilities
V.010 Identify basic mainframe attributes (e.g., size, system capacity, processor speeds, fault tolerance, security, transaction processing)
V.011 Identify common mainframe vendors (e.g., IBM, Amdahl, Hitachi Data Systems, Digital)

θθθθθ **W. Demonstrate knowledge of LAN physical media**

W.001 Differentiate between baseband and broadband transmission
W.002 Demonstrate knowledge of Manchester encoding
W.003 Identify the criteria used in making cable selection decisions (e.g., physical properties, transmission technologies, transmission span, bandwidth, topology, security, noise immunity, installation considerations, cost)
W.004 Demonstrate knowledge of cable types (e.g., coaxial, twisted-pair, optical fibers)
W.005 Compare/contrast a cable types
W.006 Demonstrate knowledge of types of cable connectors and grounding techniques
W.007 Demonstrate knowledge of typical cable applications
W.008 Demonstrate knowledge of cable standards (e.g., ANSI, EIA/TIA-568, EIA/TIA-569, TWSS, NEC)
W.009 Identify the advantages and disadvantages of LAN cabling systems
W.010 Demonstrate knowledge of LAN system physical layouts
W.011 Demonstrate knowledge of how to conduct cable installation site survey
W.012 Demonstrate knowledge of how to estimate cable and components required based on installation site survey results
W.013 Demonstrate knowledge of checks that need to be made prior to installing cable
W.014 Demonstrate knowledge of the documentation and labeling needed when installing cable
W.015 Demonstrate knowledge of accepted methods for installing cable
W.016 Demonstrate knowledge of typical problems associated with cable installation
W.017 Demonstrate knowledge of cable testing and tolerance levels
W.018 Demonstrate knowledge of possible sources of interference and methods for overcoming each

W.019 Demonstrate knowledge of basic cabling schemes and alternatives

θθθθθ **X. Demonstrate knowledge of network connectivity basics**

X.001 Demonstrate knowledge of the characteristics and functions of point-to-point channels, switched, and meshed network
X.002 Demonstrate knowledge of the characteristics and functions of broadcast channels
X.003 Identify software used to connect networking devices
X.004 Demonstrate knowledge of types of interoperability (e.g., peer-to-peer, peer-to-host)
X.005 Demonstrate knowledge of Internet, Intranet, and Extranet usage and connectivity

θθθθθ **Y. Demonstrate knowledge of LAN switching**

Y.001 Describe the advantages of LAN segmentation.
Y.002 Describe LAN segmentation using bridges.
Y.003 Describe LAN segmentation using routers.
Y.004 Describe LAN segmentation using switches.
Y.005 Name and describe two switching methods.
Y.006 Describe full- and half-duplex Ethernet operation.
Y.007 Describe network congestion problems in Ethernet networks.
Y.008 Describe the benefits of network segmentation with bridges.
Y.009 Describe the benefits of network segmentation with switches.
Y.010 Describe the features and benefits of Fast Ethernet.
Y.011 Describe the guidelines and distance limitations of Fast Ethernet.
Y.012 Distinguish between cut-through and store-and-forward LAN switching.
Y.013 Describe the operation of the Spanning Tree Protocol and its benefits.
Y.014 Describe the benefits of virtual LANs.
Y.015 Define and describe the function of a MAC address.

Network Architectures

Aligned with Vermont Standards: 7.17

θθθθθ **Z. Demonstrate knowledge of the basics of network architecture**

Z.001 Demonstrate knowledge of the characteristics and uses of network components (e.g., hub, switches, routers, firewall)
Z.002 Identify LAN transmission methods (e.g., bus, pure ring, star ring topologies)
Z.003 Demonstrate knowledge of broadband and baseband transmission methods and standards
Z.004 Demonstrate knowledge of LAN transmission logic
Z.005 Identify LAN transmission media (e.g., twisted pair, fiber-optic cable, wireless)
Z.006 Demonstrate knowledge of LAN medium-access protocols (e.g., CSMA/CD, token bus, token ring, FDDI)
Z.007 Identify the components of, and relationships within, the OSI 8802 (IEEE 802) protocol suite
Z.008 Demonstrate knowledge of LAN protocol issues with medium-access control and data communications protocol
Z.009 Identify LAN performance factors (signal attenuation, signal propagation delay)
Z.010 Compare/contrast various frame formats for LANs
Z.011 Demonstrate knowledge of frame types (e.g., SNS<802.3, 802.5)
Z.012 Demonstrate a basic knowledge of OSI modelling
Z.013 Differentiate between a physical and logical topology

θθθθθ **AA. Demonstrate knowledge of network protocols**

AA.001 Monitor Novell IPX operation on the router.
AA.002 Describe the two parts of network addressing, then identify the parts in specific protocol address examples.

AA.003 Create the different classes of IP addresses [and subnetting].
AA.004 Configure IP addresses.
AA.005 Verify IP addresses.
AA.006 List the required IPX address and encapsulation type.
AA.007 Enable the Novell IPX protocol and configure interfaces.
AA.008 Identify the functions performed by ICMP.
AA.009 Configure IPX access lists and SAP filters to control basic Novell traffic.

θθθθθ **BB. Install basic system architectures using current Windows operating system software**

BB.001 Configure a client desktop for network communications in Windows
BB.002 Share files between two computers on a network using Windows
BB.003 Design a system to direct cable-connect two computers using Windows
BB.004 Expand PC memory

WIDE-AREA NETWORKS

Aligned with Vermont Standards: 7.17

θθθθθ **CC. Demonstrate knowledge of basic telecommunications and the interconnection of networks**

CC.001 Demonstrate knowledge of WAN technology (e.g., subrate facilities, dataphone, digital service, multiplexers, time division multiplexing, modems, RS-232)
CC.002 Demonstrate knowledge of the different types of WAN connections
CC.003 Demonstrate knowledge of point-to-point (PPP) interconnection
CC.004 Identify basic telecommunications services (e.g., satellite, circuit switching, packet switching, wireless)
CC.005 Differentiate between local exchange carriers (LECs) and interexchange carriers (IXCs or IECs)
CC.006 Define local access and transport areas (LATAs)
CC.007 Identify long-distance carriers and their services
CC.008 Identify packet carriers and their services
CC.009 Identify the role of telecommunications tariffs

θθθθθ **DD. Demonstrate knowledge of WAN protocols**

DD.001 Differentiate between the following WAN services: Frame Relay, ISDN/LAPD, HDLC, & PPP.
DD.002 Recognize key Frame Relay terms and features.
DD.003 List commands to configure Frame Relay LMIs, maps, and subinterfaces.
DD.004 List commands to monitor Frame Relay operation in the router.
DD.005 Identify PPP operations to encapsulate WAN data on routers.
DD.006 State a relevant use and context for ISDN networking.
DD.007 Identify ISDN protocols, function groups, reference points, and channels.
DD.008 Add the RIP routing protocol to your configuration.
DD.009 Add the IGRP routing protocol to your configuration.
DD.010 Explain the services of separate and integrated multiprotocol routing.
DD.011 List problems that each routing type encounters when dealing with topology changes and describe techniques to reduce the number of these problems.
DD.012 Describe the benefits of network segmentation with routers.

NETWORK MANAGEMENT

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **EE. Perform network installation procedures**

EE.001 Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts)
EE.002 Assess user needs to determine which network operating systems to use
EE.003 Set up/configure workstation-network connections
EE.004 Set up/configure network components (e.g., interface cards, printers, and CD-ROM devices)
EE.005 Install modem
EE.006 Install multiplexer
EE.007 Install LAN operating system
EE.008 Configure file server in PC network
EE.009 Construct network cables
EE.010 Test network connectivity using a network analyzer
EE.011 Install cabling
EE.012 Install network

θθθθθ **FF. Perform network operation procedures**

FF.001 Determine the type of wiring needed for the physical connection of the network
FF.002 Connect PCs to form a network
FF.003 Connect PC to mini or mainframe
FF.004 Link mixed vendors (e.g., PC to Mac)
FF.005 Interconnect computers via backbone network
FF.006 Document LAN configuration
FF.007 Identify how the network protocols work together
FF.008 Determine compatibility of various networks
FF.009 Set up/configure TCP/IP services on workstations and network servers
FF.010 Implement print queue in a PC network
FF.011 Program a client-server application
FF.012 Build a synchronous transmission circuit using a modem
FF.013 Perform file-to-file copy in a PC network
FF.014 Install/configure file server in a PC network
FF.015 Operate the system in a multi-user environment

SYSTEM INSTALLATION AND MAINTENANCE

Aligned with Vermont Standards: 1.21, 7.12, 7.17

θθθθθ **GG. Perform system maintenance**

GG.001 Demonstrate knowledge of the basic elements of computer maintenance
GG.002 Identify available diagnostic tools used for system maintenance
GG.003 Identify maintenance procedures and processes
GG.004 Identify problems using diagnostic tools
GG.005 Document solutions
GG.006 Tear down a computer
GG.007 Identify (by name) new or replacement computer components needed
GG.008 Install/replace computer components
GG.009 Reassemble a computer
GG.010 Establish a preventive maintenance plan
GG.011 Perform preventive maintenance on computer components
GG.012 Create maintenance plan for regular integrity checks
GG.013 Evaluate maintenance processes
GG.014 Evaluate maintenance outcomes

θθθθθ **HH. Perform software upgrades and fixes**

HH.001 Identify principles governing software acquisition and upgrades
HH.002 Analyze operational problems
HH.003 Recommend solutions for operational problems
HH.004 Upgrade software

MANAGEMENT AND SUPERVISION

Aligned with Vermont Standards: : 1.13, 1.14, 1.17, 1.20, 2.2, 2.3, 2.14, 3.3, 3.10, 3.11, 3.12

θθθθθ **II. Conduct meetings**

- II.001 Plan meeting
- II.002 Set agenda
- II.003 Schedule meeting
- II.004 Reserve meeting room
- II.005 Invite appropriate personnel
- II.006 Identify need for outside speakers
- II.007 Assign someone to take minutes
- II.008 Make introductions
- II.009 Invite questions, comments, and group participation
- II.010 Determine appropriate action, time frame, and person accountable for identified tasks
- II.011 Monitor time
- II.012 Publish minutes in timely manner

FUNDAMENTALS OF ELECTRONICS TECHNOLOGY

Aligned with Vermont Standards: 7.11, 7.12, 7.17, 7.18, 7.19

θθθθθ **JJ. Distinguish between analog and digital phenomena and circuits**

- JJ.001 Demonstrate knowledge of the analog and digital measurement techniques for physical parameters (e.g., temperature, time, current, number of items coming down a production line)
- JJ.002 Distinguish between an analog and a digital clock
- JJ.003 Demonstrate knowledge of the function and operation of the instruments used to measure analog signals
- JJ.004 Demonstrate knowledge of the function and operation of the instruments used to measure analog digital signals
- JJ.005 Demonstrate knowledge of how an analog signal can be converted to a digital signal
- JJ.006 Demonstrate knowledge of how a digital signal can be converted to an analog signal

θθθθθ **KK. Demonstrate knowledge of the basic elements of communication interfacing**

- KK.001 Demonstrate knowledge of common EIA, IEEE, and ITU-T (formerly CCITT) communication standards (e.g., EIA 232 and 485, IEEE 488) and their applications
- KK.002 Demonstrate knowledge of the function and operation of sync devices
- KK.003 Demonstrate knowledge of the function and operation of async devices
- KK.004 Demonstrate knowledge of types of networks (e.g., token ring, Ethernet)
- KK.005 Demonstrate knowledge of networking levels or layers
- KK.006 Demonstrate knowledge of protocols
- KK.007 Demonstrate knowledge of the function and operation of packet switching
- KK.008 Demonstrate knowledge of multi-user systems
- KK.009 Demonstrate knowledge of types of network analyzer devices (e.g., breakout box, sniffers)
- KK.010 Operate network analyzer devices

θθθθθ **LL. Apply troubleshooting and repair techniques to a microcomputer system**

- LL.001 Demonstrate knowledge of the role of preventive maintenance
- LL.002 Differentiate between normal and abnormal operations
- LL.003 Demonstrate knowledge of standard troubleshooting procedures
- LL.004 Identify available troubleshooting aids and tools
- LL.005 Demonstrate knowledge of safety rules for troubleshooting and repair
- LL.006 Demonstrate knowledge of the techniques for identifying thermal failures
- LL.007 Identify logical actions to take for a specific troubleshooting situation
- LL.008 Secure needed information using diagnostic software
- LL.009 Secure needed information using manufacturer's manuals, schematics, and troubleshooting charts
- LL.010 Interpret prints
- LL.011 Isolate faults to systems boards

LL.012 Isolate faults to memory circuits
LL.013 Isolate faults to data storage devices
LL.014 Isolate faults in power supplies
LL.015 Troubleshoot I/O ports
LL.016 Isolate faults in I/O interface circuitry
LL.017 Repair faults
LL.018 Maintain troubleshooting and repair records

TELECOMMUNICATIONS

Aligned with Vermont Standards: 7.11, 7.12, 7.17, 7.18, 7.19

θθθθθ **MM. Demonstrate knowledge of transmission line applications**

- MM.001 Define power conversion
- MM.002 Demonstrate knowledge of the principles and operation of two-wire and four-wire transmission lines
- MM.003 Demonstrate knowledge of the principles and operation of coaxial cable
- MM.004 Demonstrate knowledge of the principles and operation of a microwave guide and wireless
- MM.005 Demonstrate knowledge of the principles and operation of fiber optics, analog, and digital circuits

θθθθθ **NN. Demonstrate proficiency in working with data communications**

- NN.001 Demonstrate knowledge of the principles and operation of data communications, signaling systems, codes, formats, and protocols
- NN.002 Demonstrate knowledge of the principles and operation of parallel and serial ports
- NN.003 Demonstrate knowledge of the principles and operation of synchronous and asynchronous signals
- NN.004 Demonstrate knowledge of the principles and operation of data modems
- NN.005 Operate data modems
- NN.006 Demonstrate knowledge of the principles and operation of fax machines
- NN.007 Demonstrate knowledge of the principles and operation of various types of networks (e.g., Ethernet, token ring)
- NN.008 Operate various types of networks
- NN.009 Employ accepted techniques for cable termination (e.g., UTP, COAX, FIBER)

Multi-MEDIA DESIGN CONCENTRATION
CIP: 11.0801

Occupational Skills				
The Student demonstrates the specified level of competency in occupational skills:				
0	**1**	**2**	**3**	**4**
No Exposure	**Introduced**	**Practiced**	**Entry-level**	**Competency**

DIGITAL MEDIA DESIGN

Aligned with Vermont Standards: 1.21, 2.4, 2.10, 2.14, 7.17

0 1 2 3 4

θθθθθ **L. Demonstrate knowledge of design principles**

θθθθθ **M. Demonstrate design skills**

COMPUTER GRAPHICS

Aligned with Vermont Standards: 1.21, 2.4, 2.10, 7.17

θθθθθ **N. Import graphics from peripheral devices**

θθθθθ **O. Create computer graphics using graphics software programs**

θθθθθ **P. Manipulate images**

3-D MODELING

Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθθ **Q. Demonstrate knowledge of the basic principles of 3-D modeling**

θθθθθ **R. Create and modify 3-D models**

θθθθθ **S. Map Materials and Environmental Effects**

θθθθθ **T. Apply animation techniques**

2 – D COMPUTER ANIMATION

Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθθ **U. Demonstrate knowledge of the basic principles of animation**

θθθθθ **V. Animate characters**

3 – D COMPUTER ANIMATION

Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθθ **W. Demonstrate knowledge of the basic principles of animation**

θθθθθ **X. Animate characters**

INTERACTIVE MULTIMEDIA

Aligned with Vermont Standards: 1.21, 7.17, 7.18, 7.19

θθθθθ **Y. Demonstrate knowledge of interactive media**

θθθθθ **Z. Combine media elements to produce interactive multimedia**

INTERNET BASICS

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **AA. Describe the physical and organizational structure of the Internet**

θθθθθ **BB. Use internet services and applications**

STATIC WEB PAGE DESIGN

Aligned with Vermont Standards: 1.8, 1.10, 1.18, 1.19, 1.21, 2.2, 2.12, 2.13, 2.14, 7.17, 7.18

θθθθθ **CC. Create static web pages**

θθθθθ **DD. Static web page with advanced elements**

DYNAMIC WEB PAGE DESIGN

Aligned with Vermont Standards: 1.8, 1.10, 1.18, 1.19, 1.21, 2.2, 2.12, 2.13, 2.14, 7.17, 7.18

θθθθθ **EE. Understand components of dynamic web page design**

INTERNET SCRIPTING AND PROGRAMMING

Aligned with Vermont Standards: 1.21, 2.2, 2.4, 2.13, 2.14, 7.17, 7.19

θθθθθ **FF. Integrate Scripts in Web Site Development**

θθθθθ **GG. Internet Programming Concepts**

DATABASE DESIGN AND INTERACTION

Aligned with Vermont Standards: 1.21, 7.17

θθθθθ **HH. Demonstrate knowledge of database design**

θθθθθ **II. Use databases in a web environment**

θθθθθ **JJ. Use Structured Query Language**

ADVANCED DATA COMMUNICATIONS

Aligned with Vermont Standards: 1.21, 7.17

θθθθθ **KK. Understand components of advanced communications**

SERVER DEVELOPMENT AND MAINTENANCE

Aligned with Vermont Standards: 2.2, 2.4, 2.12

θθθθθ **LL. Understand components of server development and maintenance**

INTERACTIVE MEDIA PRODUCTION PROCESS

Aligned with Vermont Standards: 1.21, 2.4, 2.10, 2.13, 2.14, 7.17, 7.19

θθθθθ **MM. Understand components of interactive media production process**

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

DIGITAL MEDIA DESIGN

Aligned with Vermont Standards: 1.21, 2.4, 2.10, 2.14, 7.17

0 1 2 3 4

θθθθθ **L. Demonstrate knowledge of design principles**

- L.001 Demonstrate knowledge of the principles and elements of design and their relationship to each other
- L.002 Demonstrate knowledge of the web safe color
- L.003 Demonstrate knowledge of picas, points, and their conversion to inches
- L.004 Integrate human factors and user interface in visual design
- L.005 Evaluate visual appeal of design

θθθθθ **M. Demonstrate design skills**

- M.001 Apply elements of design (e.g., line, shape, color)
- M.002 Develop rough and comprehensive layouts
- M.003 Create various mock-ups and dummies
- M.004 Select appropriate style for desired impact
- M.005 Design computer model objects for function
- M.006 Select appropriate media types
- M.007 Design user interface
- M.008 Design navigation schema
- M.009 Create/refine design concepts

COMPUTER GRAPHICS

Aligned with Vermont Standards: 1.21, 2.4, 2.10, 7.17

θθθθθ **N. Import graphics from peripheral devices**

- N.001 Identify types of digital imaging software
- N.002 Demonstrate knowledge of the characteristics and operation of digital imaging equipment (e.g., scanner, digital camera, video input devices, printer, and output devices)
- N.003 Compare performance of different types of image acquisition hardware

θθθθθ **O. Create computer graphics using graphics software programs**

- O.001 Compare/contrast different types of graphics software
- O.002 Demonstrate knowledge of graphic tools, menus, and functions, such as grouping, transformations and blending
- O.003 Demonstrate knowledge of simple and advanced development tools, styles, templates, and wizards
- O.004 Select the most effective graphics software for the intended uses
- O.005 Identify types of graphics
- O.006 Define audience and purpose of graphics
- O.007 Select the appropriate style of graphics based on the intended purpose
- O.008 Create graphics that integrate principles of communication and elements of visual design
- O.009 Manipulate color, shape, size, and textures of graphics
- O.010 Import objects from other applications
- O.011 Export objects to other applications
- O.012 Rotate graphics
- O.013 Rotate text

O.014 Paint/touch up images
O.015 Store images in appropriate formats and resolutions for specific applications
O.016 Save/retrieve graphics
O.017 Print graphics to various output devices

θθθθθ **P. Manipulate images**

P.001 Identify image file formats
P.002 Manipulate levels
P.003 Convert file formats
P.004 Manipulate contrast
P.005 Crop images
P.006 Scale images
P.007 Adjust images using various filtration methods
P.008 Adjust images using selection tools
P.009 Adjust images using painting and editing tools
P.010 Optimize images for specific uses

3-D MODELING

Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθθ **Q. Demonstrate knowledge of the basic principles of 3-D modeling**

Q.001 Demonstrate knowledge of how to convert objects from two-dimensional to three-dimensional
Q.002 Demonstrate knowledge of how a computer deals with geometry
Q.003 Identify the software available for 3-D modeling
Q.004 Demonstrate knowledge of the steps for building a 3-D model
Q.005 Demonstrate knowledge of the components of a wireframe model

θθθθθ **R. Create 3-D models**

R.001 Create a model using 3-D modeling software
R.002 Determine desired camera angle
R.003 Adjust lighting angle, focus, and color to achieve desired effect
R.004 Adjust surface color, texture, transparency, and reflectivity to achieve desired effect
R.005 Compare/contrast flat shading, curved shading, and ray tracing
R.006 Render the object using flat shading
R.007 Render the object using curved shading
R.008 Render the object using ray tracing
R.009 Combine models to create a scene
R.010 Render the completed scene

θθθθθ **S. Map Materials and Environmental Effects**

S.001 Create buildings and rooms
S.002 Import buildings and rooms
S.003 Create land forms
S.004 Import land forms
S.005 Create bodies of water (e.g., lakes, rivers, oceans, waterfalls)
S.006 Create basic water textures, reflections, refractions, and splashing
S.007 Incorporate fog and background images
S.008 Manipulate particle systems such as rain and snow
S.009 Apply lighting effects
S.010 Add special effects

θθθθθ **T. Apply Animation Techniques**

T.001 Follow basic animation principles
T.002 Perform basic texture-mapping algorithms
T.003 Perform basic antialiasing

T.004 Apply ray tracing and radiosity methods
T.005 Perform basic volume-rendering algorithms
T.006 Perform surface detail modeling
T.007 Develop basic curves and surfaces

2-D COMPUTER ANIMATION

Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθθ **U. Demonstrate knowledge of the basic principles of animation**

U.001 Demonstrate knowledge of the principles of continuity, key frames, motion paths, and motion
U.002 Demonstrate knowledge of the uses of special effects and virtual navigation
U.003 Identify available animation software programs/tools
U.004 Demonstrate knowledge of 2-D sprite animation
U.005 Demonstrate knowledge of the principles of cell animation

θθθθθ **V. Animate characters**

V.001 Demonstrate knowledge of how to design a character based on a narrative context
V.002 Demonstrate knowledge of how to animate a character so as to express its nature
V.003 Demonstrate knowledge of how to capture motion
V.004 Design 2-D characters
V.005 Develop characters in accordance with designs

3-D COMPUTER ANIMATION

Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθθ **W. Demonstrate knowledge of the basic principles of animation**

W.001 Demonstrate knowledge of the principles of continuity, key frames, motion paths, and motion
W.002 Demonstrate knowledge of the uses of special effects and virtual navigation
W.003 Identify available animation software programs/tools
W.004 Demonstrate knowledge of the principles of cell animation
W.005 Demonstrate knowledge of pre-rendered 3-D animation
W.006 Demonstrate knowledge of real-time 3-D animation

θθθθθ **X. Animate characters**

X.001 Demonstrate knowledge of how to design a character based on a narrative context
X.002 Demonstrate knowledge of how to animate a character so as to express its nature
X.003 Demonstrate knowledge of how to capture motion
X.004 Design 3-D models of characters
X.005 Develop characters in accordance with designs

INTERACTIVE MULTIMEDIA

Aligned with Vermont Standards: 1.21, 7.17, 7.18, 7.19

θθθθθ **Y. Demonstrate knowledge of interactive media**

Y.001 Perform critical review of various interactive media end products
Y.002 Identify rights, responsibilities, and controls related to various interactive media
Y.003 Interpret intellectual property laws relative to interactive media
Y.004 Analyze the social and cultural implications of interactive media
Y.005 Identify key criticisms of interactive media
Y.006 Identify possible markets for interactive media (e.g., sales and marketing, interactive advertising, K-12 education, corporate training, corporate communications, distance learning, news, entertainment)
Y.007 Identify specific uses of interactive media in each potential market
Y.008 Identify future trends in interactive media

θθθθθ **Z. Combine media elements to produce interactive multimedia**

Z.001 Apply visual design skills
Z.002 Generate text for multi-image presentations (e.g., title slides, charts, graphs)
Z.003 Record sound track, including narration, voice-overs, sound effects, and music
Z.004 Integrate sound with visuals
Z.005 Build in hotspots and interactive links
Z.006 Synthesize available interactive media technologies into a unified presentation using appropriate authoring software
Z.007 Select appropriate hardware tools for media creations
Z.008 Select appropriate software tools for media creations
Z.009 Select the media elements (e.g., sound, video, graphics, text, animation) to be used

INTERNET BASICS

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **AA. Describe the concepts and physical and organizational structure of the Internet**

AA.001 Define Internet Related Terminology
AA.002 Draw conceptual model of the Internet and World Wide Web
AA.003 Identify function of Internet Organizations.
AA.004 Identify characteristics of Internet Protocols
AA.005 Compare Internet connection services
AA.006 Demonstrate method for determining Internet identity of a business (hosting domain, subleasing domain, virtual domain hosting)

θθθθθ **BB. Use Internet Services and Applications.**

BB.001 Demonstrate functions and features of Internet browsers.
BB.002 Demonstrate ethics and safety on the Internet
BB.003 Demonstrate an understanding of legal issues relating to the Internet
BB.004 Use Internet Services and Applications
BB.005 Download, install and use browser, applications, and plug-ins.
BB.006 Contrast using Internet applications vs plugs-ins
BB.007 Demonstrate proper use of E-mail
BB.008 Demonstrate effective use of search engines
BB.009 Demonstrate skills in accessing and using newsgroups
BB.010 Demonstrate competency in using online resources
BB.011 Demonstrate ability to conduct business on the Internet (order processing, etc.)
BB.012 Demonstrate skills in participating in online community
BB.013 Demonstrate ability to participate in online learning module
BB.014 Install and use FTP program

STATIC WEB PAGE DESIGN

Aligned with Vermont Standards: 1.8, 1.10, 1.18, 1.19, 1.21, 2.2, 2.12, 2.13, 2.14, 7.17, 7.18

θθθθθ **CC. Create static web**

CC.001 Demonstrate knowledge of the structure of markup languages used in Web Page Design.
CC.002 Create Headers, Paragraphs, and List.
CC.003 Add Character Formatting to a Web Page.
CC.004 Insert and format images tags and attributes.
CC.005 Create and use hyperlinks and anchor tags.
CC.006 Create websites using a variety of web page structures.
CC.007 Create Styles Sheets and CSS properties in Web Page Design
CC.008 Use Font and Body tag attributes to produce color schemes in a Web Page.
CC.009 Demonstrate appropriate use of different Image types in a Web Page.

CC.010 Insert images and control image placement and size.
CC.011 Demonstrate understanding of image maps.
CC.012 Create and format tables.
CC.013 Control web page layout by controlling table appearance, alignment, and placement.
CC.014 Create a Frame Layout Web Page Design.
CC.015 Control the appearance of Frame elements.
CC.016 Control the actions of Hyperlink text within a Frame Layout.

θθθθθ **DD. Static Web Page with Advanced Elements**

DD.001 Demonstrate understanding of online form actions and methods.
DD.002 Create form elements.
DD.003 Work with form element properties.
DD.004 Identify security issues relating to use of forms.
DD.005 Create External CSS Stylesheet
DD.006 Create and apply styles to a web page.
DD.007 Apply ID, Classes, DIV and SPAN tags.
DD.008 Demonstrate effective use of CSS attributes within web page development model.

DYNAMIC WEB PAGE DESIGN

Aligned with Vermont Standards: 1.8, 1.10, 1.18, 1.19, 1.21, 2.2, 2.12, 2.13, 2.14, 7.17, 7.18

θθθθθ **EE. Understand components of dynamic web page design.**

EE.001 Create dynamic web pages that interact with the user (using DHTML)
EE.002 Use modern techniques to separate content from format (XML and XSLT)

INTERNET SCRIPTING AND PROGRAMMING

Aligned with Vermont Standards: 1.21, 2.2, 2.4, 2.13, 2.14, 7.17, 7.19

θθθθθ **FF. Integrate Scripts in Web Site Development**

FF.001 Identify the characteristics of Client Side Scripting
FF.002 Insert a client side script into a Web Page
FF.003 Modify parameters of client side script
FF.004 Identify the characteristics of Server Side Scripting
FF.005 Insert a Service-side Script into a Web Page
FF.006 Modify parameters of a Server Side Script
FF.007 Locate host service providers for various type of scripting options.
FF.008 Identify characteristics of various types of scripting languages.

θθθθθ **GG. Internet Programming Concepts**

GG.001 Use variables for data storage and calculations
GG.002 Use correct data types and naming conventions
GG.003 Calculate values
GG.004 Declare, populate, and use arrays
GG.005 Use arithmetic operators
GG.006 Implement control structure
GG.007 Use built in functions and methods
GG.008 Use event procedures
GG.009 Use built in objects of a programming language
GG.010 Create and use custom objects

DATABASE DESIGN AND INTERACTION

Aligned with Vermont Standards: 1.21, 7.17

θθθθθ **HH. Demonstrate knowledge of database design**

HH.001 Create an Entity Relationship Diagram to model a business needs and functions
HH.002 Create and populate database table
HH.003 Create relationship in a database
HH.004 Create queries from multiple tables
HH.005 Create reports from database

θθθθθ **II. Use databases in a web environment**

II.001 Use and ODBC connection
II.002 Demonstrate understanding of URL parameters
II.003 Retrieve data from a database into a Web Page
II.004 Insert data into a database from a Web Page Form
II.005 Maintain data in a database from a Web Environment

θθθθθ **JJ. Use Structured Query Language**

JJ.001 Retrieve data
JJ.002 Insert data
JJ.003 Update data
JJ.004 Delete data
JJ.005 Create and maintain database objects
JJ.006 Control transactions
JJ.007 Control data/user access
JJ.008 Retrieve data using additional advanced techniques.

ADVANCED DATA COMMUNICATIONS

Aligned with Vermont Standards: 1.21, 7.17

θθθθθ **KK. Understand components of advanced data communications.**

KK.001 Demonstrate knowledge of networking basics
KK.002 Demonstrate knowledge of networking security

SERVER DEVELOPMENT AND MAINTENANCE

Aligned with Vermont Standards: 2.2, 2.4, 2.12

θθθθθ **LL. Understand components of server development and maintenance.**

LL.001 Install an operating system to create a server
LL.002 Configure a computer to act as a Web and FTP server
LL.003 Maintain a server

INTERACTIVE MEDIA PRODUCTION PROCESS

Aligned with Vermont Standards: 1.21, 2.4, 2.10, 2.13, 2.14, 7.17, 7.19

θθθθθ **MM. Understand components of interactive media production process.**

MM.001 Identify and participate in steps of the pre-production process (i.e. planning, working with audience, etc)
MM.002 Select layout and design that best meet project goals
MM.003 Test usability of navigation and interface design
MM.004 Demonstrate understanding of accessibility and internationalization implications on project
MM.005 Participate in various phases and roles of the media creation process
MM.006 Participate in phases of project assembly, testing and optimization
MM.007 Participate in stages of production, implementation, hosting, dissemination

COMPUTER INSTALLATION & REPAIR CONCENTRATION
CIP: 47.0104

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

hardware service technician

Aligned with Vermont Standards: 1.14, 1.18, 1.19, 1.21, 7.11, 7.12, 7.17

0 1 2 3 4

θθθθθ **L. Installation, Configuration, and Upgrading**

θθθθθ **M. Diagnose and Troubleshoot**

θθθθθ **N. Preventive Maintenance, Safety, and Environmental Issues**

θθθθθ **O. Motherboards, Processors, and Memory**

θθθθθ **P. Printers**

θθθθθ **Q. Basic Networking**

Operating System Technologies

Aligned with Vermont Standards: 2.13, 7.3aaa, 7.17

θθθθθ **R. Operating System Fundamentals**

θθθθθ **S. Installation, Configuration, and Upgrade**

θθθθθ **T. Diagnose and Troubleshoot**

θθθθθ **U. Networks**

NETWORKING

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **V. Media and Topologies**

θθθθθ **W. Protocols and Standards**

θθθθθ **X. Network Implementation**

θθθθθ **Y. Network Support**

WEB PAGE DESIGN AND IMPLEMENTATION

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **Z. Create Static Web Pages**

θθθθθ **AA. Create Static Web Pages with Advanced Elements**

θθθθθ **BB. Internet Programming Concepts**

DATABASE DESIGN AND IMPLEMENTATION

Aligned with Vermont Standards: 1.21, 1.22

θθθθθ **CC. Demonstrate Knowledge of Database Design**

θθθθθ **DD. Use Structured Query Language**

θθθθθ **EE. Use Databases in a Web Environment**

COMPUTER PROGRAMMING

Aligned with Vermont Standards: 1.21, 1.22, 2.10, 2.11, 2.12, 2.13, 2.14, 7.17

θθθθθ **FF. Program Design**

θθθθθ **GG. Documentation**

θθθθθ **HH. Develop Computer Programs in Accordance with Programming Theory**

θθθθθ **II. Incorporate Testing in Programs**

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	**Introduced**	**Practiced**	**Entry-level**	**Competency**

hardware service techn**OLOGY**

Aligned with Vermont Standards: 1.14, 1.18, 1.19, 1.21, 7.11, 7.12, 7.17

0 1 2 3 4

θθθθθ **L. Installation, Configuration, and Upgrading**

- L.001 Identify the names, purpose, and characteristics of internal system components, case and ports recognizing by sight or definition
- L.002 Identify basic procedures (and appropriate sequence) for adding and removing field-replaceable components for desktop systems
- L.003 Identify basic procedures (and appropriate sequence) for adding and removing field-replaceable components for portable systems
- L.004 Identify typical IRQs, DMAs, and I/O addresses, and procedures (steps) for altering these setting when installing and configuring devices.
- L.005 Identify the names, purposes, and performance characteristics of common peripheral ports recognizing ports, cabling, and connectors by sight or definition
- L.006 Identify proper procedures and sequence for installing and configuring common IDE devices and recognize associated cables
- L.007 Identify proper procedures and sequence for installing and configuring common SCSI devices and recognize the associated cables
- L.008 Identify proper procedures for installing and configuring common peripheral devices
- L.009 Identify procedures to optimize PC operations in specific situations. Predict the effects of specific procedures under given scenarios (Cooling systems, Disk subsystem enhancements, NICs, Specialized video cards, Memory, Additional processors)
- L.010 Determine the issues that must be considered when upgrading a PC including when and how to upgrade system components

θθθθθ **M. Diagnose and Troubleshoot**

- M.001 Recognize common problems associated with each component and their symptoms, identifying steps to isolate and troubleshoot the problems and finding the most likely cause (Ports and cables, Motherboards, Peripherals, Computer case, Storage devices and cables, Cooling systems, Processor, Memory, Display device, Input devices, Adapters, Portable systems)
- M.002 Identify basic troubleshooting procedures and tools, and how to elicit problem symptoms from the customer (Gather information, Determine whether the problem is a hardware or software problem, Troubleshoot to isolate the problem)

θθθθθ **N. Preventive Maintenance, Safety, and Environmental Issues**

- N.001 Identify the various types of preventive maintenance measures, products and procedures and when and how to use them (Cleaning compounds, Non-static vacuums, Cleaning monitors and removable media devices, Ventilation, dust and moisture control inside the PC, Hard disk maintenance, Verifying integrity of UPS and suppressors)
- N.002 Identify various safety measures and procedures, and when/how to use them (ESD: What it is and how to protect from it, Potential hazards and proper safety procedures: High-voltage equipment, Power supplies, CRTs)
- N.003 Identify environmental protection measures and procedures, and when/how to use them (Disposal guidelines: batteries, CRTs, chemical solvents and cans, MSDS (Material Safety Data Sheet))

θθθθθ **O. Motherboards, Processors, and Memory**

O.001 Distinguish between the popular CPU chips in terms of their basic characteristics (Pentium class compatible, voltage, speeds, cache, sockets/slots, VRMs)

O.002 Identify the types of RAM, form factors, and operational characteristics and determine banking and speed requirements under different scenarios (RAM: EDO RAM, DRAM…, Form factors: SIMM, DIMM…, Operational characteristics: 8, 16, 32-bit, parity vs non-parity, ECC vs. non-ECC, single-sided vs. double-sided),

O.003 Identify the most popular types of motherboards, their components, and their architecture (bus structure) (AT/ATX, chipsets, ports, memory, processor socket, external cache, bus architecture, expansion slots, IDE (ATA, ATAPI, ULTRA-DMA, EIDE), SCSI)

O.004 Identify the purpose of CMOS memory, what it contains, and how and when to change its parameters. Given a scenario involving CMOS, choose the appropriate course of action.

θθθθθ **P. Printers**

P.001 Identify printer technologies, interfaces, and options/upgrades (Technologies: Laser, ink dispersion, dot matrix, solid ink, thermal, dye sublimation, Interfaces: Parallel, network, SCSI, USB, infrared, serial, IEEE1394/Firewire, wireless, options/upgrades: memory, hard drives, NICs, trays and feeders, finishers (stapling, etc.), Scanner/Fax/copier)

P.002 Recognize common printer problems and techniques used to resolve them

θθθθθ **Q. Basic Networking**

Q.001 Identify the common types of network cables, their characteristics and connectors (Cable types: coaxial, plenum/PVC, UTP, STP, Fiber, Connector types: BNC, RJ-45, AUI, ST/SC, IDC/UDC)

Q.002 Identify basic networking concepts including how a network works (Install and configure NICs, addressing, bandwidth, status indicators, protocols, full-duplex, half-duplex, cabling, networking models (peer-to-peer, client/server), infrared, wireless)

Q.003 Identify common technologies available for establishing Internet connectivity (LAN, DSL, cable, ISDN, dial-up, satellite, wireless) and their characteristics (definition, speed, connections)

OPERATING SYSTEM TECHNOLOGIES

Aligned with Vermont Standards: 2.13, 7.3aaa, 7.17

θθθθθ **R. Operating System Fundamentals**

R.001 Identify the major desktop components and interfaces, and their functions differentiating the characteristics of current versions of Microsoft Windows (Windows 9x/Me, NT4.0 Workstation, 2000 Professional, and XP)

R.002 Identify the names, locations, purposes, and contents of major file systems (Windows 9x and NT-based systems)

R.003 Demonstrate the ability to use command-line functions and utilities to manage the operating system, including the proper syntax and switches (DOS commands)

R.004 Identify basic concepts and procedures for creating, viewing, and managing disks, directories and files including procedures for changing file attributes and the ramifications of those changes (Disk partitions, file systems, directory structures, files)

R.005 Identify the major operating system utilities, their purposes, location, and available switches (Disk management tools, System management tools, File management tools)

θθθθθ **S. Installation, Configuration, and Upgrade**

S.001 Identify the procedures for installing current Microsoft operating systems and bringing the operating systems to a basic operational level (Windows 9x/Me, NT4.0 Workstation, 2000 Professional, and XP) (Verify hardware compatibility and minimum requirements, Determine OS installation options, Disk preparation order, Run appropriate setup utility (Setup, Winnt), Installation methods, Device driver configuration, Restore user data files, Identify common symptoms and problems)

S.002 Identify steps to perform an operating system upgrade using combinations of current Microsoft Windows operating systems. Given an upgrade scenario, choose the appropriate next step.

(Upgrade paths available, Verify hardware compatibility and minimum requirements, Verify application compatibility, Determine correct upgrade startup utility, Apply OS service packs, patches and updates, Install additional Windows components

S.003 Identify the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed for each current Windows operating system version (Boot sequence, Alternative boot methods, Creating emergency disks with DOS utilities, Creating ERD with Windows)

S.004 Identify procedures for installing/adding a device including loading, adding, and configuring device drivers and required software (Determine if permissions are adequate for performing the task, Device driver installation, Install additional Windows components)

S.005 Identify procedures necessary to optimize the operating system and major operating system subsystems (Virtual memory management, disk defragmentation, files and buffers, caches, temporary file management)

θθθθθ **T. Diagnose and Troubleshoot**

T.001 Recognize and interpret the meaning of common error codes and startup messages from the boot sequence, and identify steps to correct the problems (Boot failure and errors, Startup messages, A device referenced in SYSTEM.INI, WIN.INI, Registry is not found, Event log is full, Failure to start GUI, Windows protection error, Registry corrupt, Use the correct utilities (Dr. Watson, Boot Disk, Event Viewer))

T.002 Recognize when to use common diagnostic utilities and tools. Given a diagnostic scenario involving one of these utilities or tools, select the appropriate steps needed to resolve the problem (Startup disks, Startup modes, Diagnostic tools, utilities, and resources, Elicit symptoms from the customer, Have customer reproduce error, Identify recent changes to the system)

T.003 Recognize common operational and usability problems and determine how to resolve them (Troubleshooting Windows-specific printing problems, Other common problems, Viruses and virus types)

θθθθθ **U. Networks**

U.001 Identify the networking capabilities of Windows. Given configuration parameters, configure the operating system to connect to a network (Configure protocols, Configure client options, Verify the configuration, Understand the use of network troubleshooting commands, Share resources, Set permissions to shared resources, Network type and card)

U.002 Identify the basic Internet protocols and terminologies. Identify procedures for establishing Internet connectivity. In a given scenario, configure the operating system to connect to and use Internet resources (Protocols and terminologies: ISP, TCP/IP, etc.), Connectivity technologies (Dial-up, DSL, etc.), Installing and configuring browsers, Firewall protection under Windows XP)

NETWORKING

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **V. Media and Topologies**

V.001 Describe or identify network topologies (e.g., star, bus, mesh, ring, wireless)

V.002 Specify the main features of current popular 802 standard networking technologies (LLC, Ethernet, token ring, wireless and FDDI) include speed, access, method, topology, and media

V.003 Specify the characteristics of 10BASE2, 10BASE5, 10BASET…Gigabit Ethernet (speed, access, method, topology, and media)

V.004 Recognize media connectors and describe their uses (RJ-11, RJ-45, AUI, BNC, ST/SC)

V.005 Choose the appropriate media type and connectors to add a client to an existing network

V.006 Identify the purpose, features, and functions of the following network components: hubs, switches, bridges, routers, gateways, CSU/DSU, NICs/ISDN adapters, wireless access points, modems

θθθθθ **W. Protocols and Standards**

W.001 Identify and explain a MAC address

W.002 Identify the seven layers of the OSI model and their functions
W.003 Differentiate between the following network protocols in terms of routing, addressing schemes, interoperability, and naming conventions: TCP/IP, IPX/SPX, NetBEUI, AppleTalk
W.004 Identify the OSI layers at which the following network components operate: hubs, switches, bridges, routers, network interface cards
W.005 Define the purpose, function and/or use of the following protocols within TCP/IP: IP, TCP, UDP, FTP,TFTP, SMTP, HTTP, HTTPS, POP3/MAP4, TELNET, ICMP, ARP, NTP
W.006 Define the function of TCP/UDP ports and identify well known ports
W.007 Identify the purpose of the following network services: DHCP/bootp, DNS, NAT/ICS, WINS, and SNMP
W.008 Identify IP address and their default subnet masks (Ipv4, Ipv6)
W.009 Identify the purpose of subnetting and default gateways
W.010 Identify the differences between public vs. private networks
W.011 Identify the basic characteristics (speed, capacity, media) of the following WAN technologies: Packet switching vs. circuit switching, ISDN, FDDI, ATM, Frame Relay, Sonet/SDH, T1/E1, T3/E3, OCx
W.012 Define the function of these remote access protocols and services: RAS, PPP, PPTP, ICA
W.013 Identify security protocols and describe their purpose and function: IPsec, L2TP, SSL, Kerberos

θθθθθ **X. Network Implementation**

X.001 Identify the basic capabilities of these server operating systems: UNIX/ Linux, Netware, Windows, Macintosh (i.e. client support, interoperability, authentication, file and print services, application support, and security)
X.002 Identify the basic capabilities of client workstations (i.e., client connectivity, local security mechanisms, and authentication)
X.003 Identify the main characteristics of VLANs
X.004 Identify the main characteristics of network attached storage
X.005 Identify the purpose and characteristics of fault tolerance
X.006 Identify the purpose and characteristics of disaster recovery
X.007 Given a remote connectivity scenario configure the connection (e.g., IP, IPX, dial-up, PPPoE, authentication, physical connectivity etc.)
X.008 Identify the purpose, benefits and characteristics of using a firewall
X.009 Identify the purpose, benefits and characteristics of using a proxy
X.010 Given a scenario, predict the impact of a particular security implementation on network functionality (e.g., blocking port numbers, encryption, etc.)
X.011 Given a network configuration, select the appropriate NIC and network configuration settings (DHCP, DNS, WINS, protocols, NETBIOS/host name, etc.)

θθθθθ **Y. Network Support**

Y.001 Given a troubleshooting scenario, select the appropriate TCP/IP utility: Tracert, Ping, Arp, Netstat, Nbstat, Ipconfig/Ifconfig, Winipcfg, Nslookup
Y.002 Given a troubleshooting scenario involving a small office/home office network failure identify the cause of the failure (e.g., xDSLl, cable, home satellite, wireless, POTS)
Y.003 Given a troubleshooting scenario involving a remote connectivity problem identify the cause of the problem (e.g., authentication failure, protocol configuration, physical connectivity)
Y.004 Given specific parameters, configure a client to connect to the following servers: UNIX/Linux, Netware, Windows, Macintosh
Y.005 Given a wiring task, select the appropriate tool: Wire crimper, media tester/certifier, punch down tool, tone generator optical tester, etc.
Y.006 Given a network scenario interpret visual indicators to determine the nature of the problem (e.g., link lights, collision lights, etc.)
Y.007 Given output from a diagnostic utility, identify the utility and interpret the output (e.g., tracert, ping, etc.)
Y.008 Given a network problem scenario, predict the impact of modifying, adding, or removing network services on network resources and users (e.g., DHCP, DNS, WINS, etc.)
Y.009 Given a network problem scenario, select an appropriate course of action based on a general troubleshooting strategy. (*See Network+ Exam Objective 4.9 for steps)

Y.010 Given a troubleshooting scenario involving a network with a particular physical topology (i.e., bus, star, mesh, ring, and wireless) and including a network diagram, identify the network area affected and the cause of the problem
Y.011 Given a network troubleshooting scenario involving a client connectivity problem (e.g., incorrect protocol/client software/authentication configuration, or insufficient rights/permission), identify the cause of the problem
Y.012 Given a network troubleshooting scenario involving a wiring/infrastructure problem, identify the cause of the problem (e.g., bad media, interference, network hardware)

WEB PAGE DESIGN AND IMPLEMENTATION

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **Z. Create Static Web Pages**

Z.001 Demonstrate knowledge of the structure of markup languages used in Web Page Design
Z.002 Create headers, paragraphs, and lists
Z.003 Add character formatting to a Web Page
Z.004 Insert and format image, tags and attributes
Z.005 Create and use Hyperlinks and Anchor tags
Z.006 Create Web sites using a variety of Web page structures
Z.007 Create style sheets in Web Page design
Z.008 Use font and body tag attributes to produce color schemes in a Web Page
Z.009 Demonstrate appropriate use of different image types in a Web Page
Z.010 Insert images and control image placement and size
Z.011 Demonstrate understanding of image maps
Z.012 Create and format tables
Z.013 Control Web page layout by controlling table appearance, alignment, and placement
Z.014 Create a frame layout Web Page design
Z.015 Control the appearance of frame elements
Z.016 Control the actions of Hyperlink text within a frame layout

θθθθθ **AA. Create Static Web Pages with Advanced Elements**

AA.001 Demonstrate understanding of online form actions and methods
AA.002 Create form elements
AA.003 Work with form element properties
AA.004 Identify security issues related to the use of forms
AA.005 Create and apply styles to a Web page

θθθθθ **BB. Internet Programming Concepts**

BB.001 Use variables for data storage and calculations
BB.002 Use correct data types and naming conventions
BB.003 Calculate values
BB.004 Declare, populate, and use arrays
BB.005 Use arithmetic operations
BB.006 Implement control structures
BB.007 Use built-in functions and methods
BB.008 Use event procedures
BB.009 Use built-in objects of a programming language
BB.010 Create and use custom objects

Database Design and Implementation

Aligned with Vermont Standards: 1.21, 1.22

qqqqq **CC. Demonstrate Knowledge of Database Design**

CC.001 Create an entity relationship diagram to model the needs and functions of a business
CC.002 Create and populate database tables
CC.003 Create relationships in databases
CC.004 Create calculated fields
CC.005 Create queries from multiple tables
CC. 006 Create forms from one or more tables
CC.007 Create simple and complex reports from one or more tables (detail, summary, subtotals/total)

θθθθθ **DD. Use Structured Query Language**

DD.001 Retrieve data based on conditions
DD.002 Insert data based on conditions
DD.003 Update data based on conditions
DD.004 Delete data based on conditions
DD.005 Create and maintain database objects
DD.006 Control transactions
DD.007 Control data/user access

θθθθθ **EE. Use Databases in a Web Environment**

EE.001 Use an ODBC connection
EE.002 Demonstrate an understanding of URL parameters
EE.003 Insert data from a database into a Web Page
EE.004 Insert data into a database from a Web Page form
EE.005 Maintain data in a database from a Web Environment

COMPUTER PROGRAMMING

Aligned with Vermont Standards: 1.21, 1.22, 2.10, 2.11, 2.12, 2.13, 2.14, 7.17

θθθθθ **FF. Program Design: Algorithm and Code Development**

FF.001 Provide an overview of the problem to be solved
FF.002 Break down the task into its functional components (i.e., the methods that will be used to solve the problem)
FF.003 Design program logic using both graphical and pseudocode techniques
FF.004 Describe the fundamental data types in your plan and their definitions
FF.005 Translate data structures and program design into code in a programming language
FF.006 Develop algorithms and read algorithms developed by others
FF.007 Compare and contrast various algorithmic solutions to a problem identifying the pros and cons to each
FF.008 Complete a desk check of an algorithm to test its viability

θθθθθ **GG. Documentation: Demonstrate knowledge of technical documentation associate with software development**

GG.001 Document program specifications
GG.002 Identify constraints
GG.003 Identify input and output (I/O) requirements
GG.004 Write programs that include comments, tabs, white space, and variable naming conventions that allow for self-documenting code
GG.005 Write useful user documentation that describes the program and its limitations, and allows the user to run the program and resolve common problems.

θθθθθ **HH. Develop Structured Computer Programs in Accordance with Programming Theory**

HH.001 Demonstrate knowledge of a variety of keywords and commands
HH.002 Save and load programs
HH.003 Utilize the compile, edit, and debug features of the compiler

HH.004 Demonstrate the ability to use standard data types, constants and variables
HH.005 Demonstrate an understanding and handling of string data
HH.006 Design and write interactive programs controlling screen input/output
HH.007 Use appropriate error trapping
HH.008 Understand and use the formatting features of the language
HH.009 Demonstrate use of decision and selection structures
HH.010 Demonstrate knowledge and use of math operators and order of operations precedence
HH.011 Demonstrate knowledge and use of relational and logical operators
HH.012 Use counters and accumulators to produce summary information
HH.013 Use menus and procedures/functions to control flow of complex programs
HH.014 Demonstrate knowledge of one and two-dimension arrays
HH.015 Demonstrate knowledge and use of pre-defined and user-defined functions
HH.016 Demonstrate an understanding of parameter passing
HH.017 Use sorting effectively in a program
HH.018 Use searching effectively in a program
HH.019 Develop and use data files

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II. Incorporate Testing in Programs

II.001 Write programs that handle solvable run-time errors such as data entry errors, file-not-found, divide by zero, etc.
II.002 Correct syntax and lexical errors allowing programs to compile
II.003 Correct common run-time errors
II.004 Create test data and plan for checking logic and error routines
II.005 Execute programs with test data
II.006 Analyze test results
II.007 Correct logic errors
II.008 Retest programs
II.009 Thoroughly test programs to make sure they follow specifications, and that all sources of possible error are handled appropriately

VERMONT FRAMEWORK OF STANDARDS AND LEARNING OPPORTUNITES

CROSSWALK (INFORMATION TECHNOLOGY PROGRAM CLUSTER COMPETENCIES)

Fields of Knowledge Area	**VT Framework Academic Standard Addressed**	**Program Core Competency** Crosses all Programs	**PROGRAMMING Concentration Competency**	**NETWORK MANAGEMENT Concentration Competency**	**INTERACTIVE MEDIA Concentration Competency**	**INFORMATION SUPPORT AND MAINTENANCE Concentration Competency**
Science, Mathematics, and Technology	7.2 aa.-ff.– Inquiry, Experiment and Theory - design and conduct investigations and projects.	D, E, F		C,D,E,F		
	7.3 aaa. – Inquiry, Experiment and Theory - understand the nature of mathematical, scientific, and technological theory.	D, E, F		C,D,E,F,G,H		G-J
	7.11 aaa., bbb. - Systems - collections of interrelated parts and interconnected systems.	A, B, C		Y,Z,AA,AB		A-F
	7.12 f., ee.,ff., fff.– Space, Time and Matter - understand forces and motion, the properties and composition of matter, and energy sources and transformations.			V,W,Y,Z,AA,AB		A-F
	7.17 bb., dd., ddd. - Design and Technology – technological systems.	A - G	B,C,D	A-W,Y-AB	A-Z,AB	A-Q,U-X
	7.18 bb., bbb.– Design and Technology - outputs and impacts of technology.	A, B, C, G,		Y-AB	N,OR,S,T	
	7.19 aaa., bbb.– Design and Technology - processes to design solutions to problems.		H	Y-AB	U,V,AB	

Vital Results	VT Framework Standard Addressed	Program Core Competency Crosses all Programs	PROGRAMMING Concentration Competency	NETWORK MANAGEMENT Concentration Competency	INTERACTIVE MEDIA Concentration Competency	INFORMATION SUPPORT AND MAINTENANCE Concentration Competency
Communication	1.8 j., k.– organize and convey information and ideas written reports.	H,I	F		R,S,T	
	1.10 cc.– organize and relate a series of steps in written procedures.	H,I	F		R,S,T	
	1.13 a.-c. – listen and respond to communications.	H,I	C,F	C,D,E,F,X		
	1.14 a.-e. - critique what they have heard.	D,E,F,H,I	F	X		A-F
	1.15 a.-g. – verbal and nonverbal skills to express themselves effectively.	H,I				
	1.17 aaa. – interpret and communicate using mathematical, scientific, and technological notation and representation.	H,I	F	X	F,G,H,I,J,K,L	
	1.18 – computers, telecommunications to research.	A-I		C,D,E,F	R,S,T	A-F
	1.19 –organizational systems.	D,E,F,H,I	C	C,D,E,F	R,S,T	A-F
	1.20 – graphs, charts to communicate.	H,I		X		
	1.21 – technologies and applications to solve problems.	H,I	A,B,C,E	A,B,I,J,K,L,M,T,U,V,W	A-Z, AB	A-F,K-X
	1.22 – simulate and model	H,I				R-X
Reasoning and Problem Solving	2.2 aa.-ee. – reasoning strategies, knowledge, and common sense to solve complex problems.	D,E,F	A,B,C,E,G	C,D,E,F,X	U,V,AA	
	2.3 aa., aaa., c. – solve problems of increasing complexity.		D	X		

	2.4 a.-f. – effectiveness of a system.		A,B,C,D,E,G		A-E, U,V,AA,AB	
	2.10 – generate several ideas using a variety of approaches.		C,D,E	A,B,I,J,K,L,MT,U	A-E,P,Q,AB	K-Q,U-X
	2.11 - represent in detailed form.		D,F			U-X
	2.12 – modify or change their original ideas to generate innovative solutions.		D,G		R,S,AA	U-X
	2.13 – design a product, project, or service.		B,D,E,H		R,S,U,V,AB	G-J,U-X
	2.14 – plan and organize an activity.		B,C,E	A,B,I,J,K,L,M,T,U,X	A,B,P,Q,R,S,T,U,V,AB	K-Q,U-X
Personal Development	3.3 – demonstrate respect.					
	3.10 – perform effectively on teams.	K				
	3.11 – interact respectively with others.	K				
	3.12 –systemic and collaborative problem-solving processes.	K				
	3.13 – roles and responsibilities in their family, their school, and their community.	K				
	3.14 dd. - demonstrate dependability, productivity, and initiative.	K				
	3.15 aaa. - Students know about various careers.	K				
	3.16 – transition planning	K				
Civic / Social Responsibility	4.3 – understanding of cultural expressions.	J				
	4.4 – understanding of the concept of prejudice.	J				